PORTLAND HARBOR RI/FS

# ROUND 3 FIELD SAMPLING PLAN SEDIMENT TRAPS

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| | |
|---|---|
| **ACG** | analytical concentration goal |
| **CERCLA** | Comprehensive Environmental Response, Compensation, and Liability Act |
| **CLP** | Contract Laboratory Program |
| **COIs** | chemicals of interest |
| **CRD** | Columbia River Datum |
| **DGPS** | differential global positioning system |
| **EPA** | U.S. Environmental Protection Agency |
| **FC** | Field Coordinator |
| **FSP** | Field Sampling Plan |
| **HSP** | Health and Safety Plan |
| **LWG** | Lower Willamette Group |
| **LWR** | lower Willamette River |
| **MDL** | method detection limit |
| **MRL** | method reporting limit |
| **NAD** | North American Datum |
| **ODEQ** | Oregon Department of Environmental Quality |
| **PAH** | polycyclic aromatic hydrocarbons |
| **PCB** | polychlorinated biphenyls |
| **QA** | quality assurance |
| **QC** | quality control |
| **QAPP** | Quality Assurance Project Plan |
| **RI/FS** | remedial investigation/feasibility study |
| **RM** | river mile |
| **SOP** | standard operating procedure |
| **SVOCs** | semivolatile organic compounds |
| **TOC** | total organic carbon |
| **TPH** | Total petroleum hydrocarbon |
| **VOCs** | volatile organic compounds |

# 1.0 INTRODUCTION

In conjunction with the remedial investigation/feasibility study (RI/FS) of the Portland Harbor Superfund Site (Site), the Lower Willamette Group (LWG) has conducted two previous rounds of sediment and surface water sampling and analysis. The efforts focused on the reach of the lower Willamette River between river miles (RMs) 2 and 11 (Study Area), although the initial study area extends from RM 3.5 to RM 9.2. To supplement the results of these previous investigations and provide additional data for informing the Feasibility Study (FS), the LWG proposes to proceed with a third round of sampling and analysis involving surface water sampling, sediment traps to sample suspended sediment settling from the surface water column, and collection of sediment samples from the bottom.

This Field Sampling Plan (FSP) presents the approach and procedures to implement Round 3 sediment trap sampling activities. Companion FSPs for Round 3 surface water sediment sampling and analysis will be submitted separately.

A Round 2 Quality Assurance Project Plan (QAPP; Integral and Windward 2004) and Round 2 QAPP Addendum for Surface Water Sampling (Integral 2004a) were previously submitted and approved for Round 2 sampling activities. Both documents apply to the sampling and analysis activities proposed for Round 3, and therefore, are proposed for use in supporting Round 3 sediment trap sampling activities. These two documents supplement this FSP in describing the field sampling and laboratory analysis procedures to accomplish the sample collection and analysis during the Round 3 sediment trap investigation. The Health and Safety Plan (HSP; Integral 2004b) prepared and approved for the Round 2 sampling program will be used as guidance for all aspects of Round 3 sediment trap sampling. The following subsection (1.1) summarizes the objectives of Round 3 sediment trap sampling, the types of data to be collected, and the approach proposed to accomplish the collection and address the objectives.

## 1.1 OBJECTIVES OF ROUND 3 SEDIMENT TRAP SAMPLING

The primary purpose of Round 3 sediment trap sampling is to gather data for the evaluation of FS alternatives. In addition, this sediment trap work will contribute to filling data gaps related to the nature and extent of potential sources and will support the preparation of the ecological risk assessment. While the Round 3 sediment trap sampling efforts focus on particular objectives described below, the sampling design has been developed to provide data suitable for other general information needs of the overall project through completion of the FS.

The specific objectives of the Round 3 sediment trap sampling program are to collect sediment trap mass and chemical concentration data to further characterize the nature and extent of waterborne sediment contamination that enters the Study Area from upstream sources, is associated with regional sources within the Study Area, and exits the downstream end of the Study Area. The data will support the FS in terms of providing better understanding of potential inputs from regional sources, potential contributions from within and outside the Study Area, and the potential for recontamination and/or natural recovery of bedded sediments within the context of FS alternatives. The sediment trap sampling program is not designed to support estimation of chemical mass loading within or throughout the system.

These overall objectives can be related to specific data analyses within the RI/FS as follows:

1. Nature and extent of surface water contamination – fill relevant data gaps from Round 2A on the general nature and extent of chemicals in river surface waters.
2. Ambient conditions – collect data on waterborne sediment chemical concentrations entering the Study Area to help inform a characterization of ambient conditions (i.e., releases not related to this Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] site).
3. Source control/recontamination – collect data to understand the regional impact of any ongoing sources (e.g., upland stormwater runoff, direct discharge, and bank erosion) to the river and sediments, and support estimates of the potential for future recontamination of remediated sediment areas.
4. Monitored natural recovery – collect data to support evaluation of potential natural recovery of sediments in marginally-contaminated sediment areas.
5. Fate and transport evaluations – collect data to help (1) define the long term risk of potential remedial options evaluated in the FS and (2) define to what extent the contaminants posing risks in tissue originate from the sediment bed (i.e., resuspension of bed sediments) indirectly via resuspension to the water column.

**Summary Approach**

To investigate the settling sediment load, pairs of sediment traps will be deployed and maintained on both sides of the river approximately at RM 2, RM 6, just upstream of RM 11, and approximately at RM 16. Individual sediment traps will be deployed and maintained at seven other locations throughout the Study Area and at one location in Multnomah Channel. The number and locations of sediment traps and the frequency of recovery and redeployment are designed to capture anticipated spatial and temporal variability of suspended sediment mass and to investigate the potential accumulation of suspended sediment chemical constituents in suspected depositional areas.

As much as possible, the sediment trap sampling efforts conducted during Round 3 will be designed to supplement data available for the overall project. While supplementing other data needs (e.g., hydrodynamic modeling efforts) is a consideration for Round 3 sampling, the overall design of Round 3 sediment trap investigation will focus on the specific Round 3 objectives described above.

## 1.2 CONTEXT OF THIS SAMPLING IN THE OVERALL PROJECT APPROACH

The collection of sediment trap data is one type of data collection that will help support a development of the FS as it relates to the objectives discussed in the previous section including: refining the nature and extent of river contamination, ambient conditions, source control/recontamination issues, the potential for monitored natural recovery of bed sediments, and better understanding the fate and transport of chemicals in the river. Sediment trap information will be combined with Round 2 sediment chemistry data, Rounds 2 and 3 surface water data, additional Round 3 sediment core and surface sample data, Rounds 2 and 3 transition zone water samples, Round 3 radioisotope cores, and information gathered through DEQ programs regarding sources of chemicals to the river. All of this information together will be used to support development of the FS after all (or nearly all) elements of the Round 3 sampling are complete. This combined data set will be used in both qualitative and quantitative data evaluations supporting development of the FS including:

- Modeling efforts that are focused on estimating the future potential for recontamination of sediment surfaces after cleanup, the long-term risks associated with remedial alternatives, and the potential for natural recovery of marginally-contaminated bedded sediments. These evaluations will help determine the overall effectiveness of various types of remedial alternatives that will be evaluated in the FS.

- Setting ambient concentrations of chemicals in sediments and surface waters through quantifying the chemical concentrations present on sediments entering the river from upstream of any site activities. Per the Work Plan, background concentrations will be relevant in developing Preliminary Remediation Goals, which are used to define the effectiveness of remedial alternatives.

- Defining the contribution of water column chemicals to tissue risks that originate from surface water sources (such as stormwater) vs. the sediment bed (i.e., resuspension of bed sediments). This evaluation will also help determine the effectiveness of remedial alternatives by better defining the extent to which sediment clean up will contribute to reduced chemical concentrations (i.e., reduced risks) in fish tissue.

## 1.3 DOCUMENT ORGANIZATION

The remaining sections of this document describe the sampling approach and field procedures that will be used to collect sediment trap samples during Round 3. Section 2 presents an overview of the sampling design and rationale. Section 3 summarizes procedures that will be used in the field. Section 4 describes how the data will be reported. Section 5 outlines the project organization and coordination. Finally, Section 6 provides references.

# 2.0 SAMPLING DESIGN AND RATIONALE

This section describes data needs and the rationale for the suspended sediment sampling program design that will support the Round 3 objectives discussed above.

## 2.1 DATA NEEDS

There are relatively few chemical analytical data points for suspended sediments entering, potentially settling within, and exiting the Study Area. Water column sediment samples will be collected using sediment traps and analyzed in Round 3 primarily to support site characterization and FS data needs as detailed below. As noted above, the sediment trap data are only one of the data inputs to the evaluations discussed below. Other important data that will support evaluations such as recontamination, fate and transport, and natural recovery modeling include (but are not limited to): Round 2A surface water data, additional Round 3 surface water investigations, additional Round 3 sediment bed chemistry sampling, additional radioisotope coring, and transition zone water sampling. These data collection efforts have either been described previously or will be described in upcoming FSPs for future monitoring events.

### 2.1.1 Nature and Extent

Sediment trap chemistry and sediment mass data help develop an understanding of in-river impacts of potentially active sources within the Study Area and estimate the chemical contributions exiting the Study Area associated with suspended solids. Sediment trap data also help to understand the extent to which bedded sediment chemicals are transported into the water column via resuspension and become available for transport to other locations within and outside the study area. Thus, these data provide a better understanding of the nature and extent of chemicals in the system.

### 2.1.2 Background

Per Objective 2 in Section 1, sediment trap data (particularly at the upstream boundary) provide information on the chemicals present in suspended sediments entering the study area. These chemical concentrations can help establish the levels that are relevant to ambient conditions upstream of any activities within the site. Further, these chemical concentrations can be one factor in determining the long-term concentrations of chemicals in depositional areas after sediment cleanup has taken place, and thereby help establish chemical concentrations below which bedded sediments cannot be remediated through actions taken entirely within the study area.

### 2.1.3 Source Control, Recontamination, and Monitored Natural Recovery

Per Objectives 3 and 4 in Section 1, sediment trap data provide information on the chemical concentrations and mass available in the water column that interact with bedded sediments. This information is relevant to understanding how cleanup of bedded sediments may control "internal" sources to the river via resuspension and thereby reduce the amount of chemicals available in the system that can act as a source to other (usually downstream) cleaner areas. As noted above, sediment trap data collected at the upstream boundary of the Study Area also provide information on the chemical concentrations that remediated sediment beds may return to (i.e., recontamination) after a sediment cleanup is complete and upland sources within the study area are controlled. Similarly, sediment trap data can be compared to chemical concentrations in marginally-contaminated sediment areas to help assess whether chemical concentration in those areas have the potential to decrease over time. Where suspended sediment concentrations are greater than bedded sediment concentrations, bedded sediments in depositional areas tend not to recover to lower concentrations. As noted above, sediment trap data will be a quantitative input to bedded sediment models to help predict whether recontamination or monitored natural recovery are likely scenarios, and if so, where.

### 2.1.4 Fate and Transport

Per Objective 5 in Section 1, sediment trap data provide information on the movement of chemicals within the system. With comparison to surface water and bedded sediment data, the contribution of resuspension to chemical concentrations in suspended sediment can be better understood. This is relevant to understanding the long-term risks associated with remedial alternatives (i.e., whether remediated areas will recontaminate and to what extent). Similarly, understanding resuspension effects can help determine the extent to which chemical burdens in fish tissue are caused by chemicals from bedded sediments or other surface water chemical contributions.

## 2.2 SAMPLE LOCATIONS

The LWG and EPA have established 16 sediment trap locations in the lower Willamette River for Round 3 suspended sediment collection (Figures 2-1a-e). The two farthest upstream pairs of locations (approximately RM 16 and RM 11) and the farthest downstream pair (approximately RM 2) are intended to assess the chemical constituents associated with suspended load entering from upstream and exiting downstream, respectively. The pair at RM 16 is intended to provide data upstream of any potential sources in the downtown Portland corridor between RMs 16 and 11. The pair at RM 11 is intended to provide comparative data on the chemical nature of suspended sediment directly entering the Study Area from the downtown corridor immediately upstream. Pairs are intended to assess cross-river differences and provide a measure of redundancy at important boundary locations. The Multnomah Channel location is intended to assess the chemical characteristics of suspended sediment associated with flow from the lower Willamette

River into the channel. Table 2-1 provides details related to selection of proposed sediment trap locations. Table 2-2 lists the station identification and the proposed coordinates for each sediment trap location. Section 3.8 describes the sample identification scheme for sediment trap samples.

In response to requests from EPA, a number of locations were placed at expected depositional areas within the Study Area. One pair was placed at RM 6 to coincide with the surface water transect at that location.

A reconnaissance visit may be conducted to inspect the proposed sample locations before sediment traps are deployed, if necessary, to verify target positions relative to potential sources, assess whether spatial coverage is adequate, and possibly adjust target locations based on the reconnaissance information.

Conditions encountered in the field during field activities may result in modifications to the sampling design; however, EPA will be contacted whenever changes in the sampling design may be required.

## 2.3 SAMPLING SCHEDULE

Sediment traps will be deployed for approximately one year. They will be recovered quarterly, and the accumulated sediment will be collected for analysis.

## 2.4 NUMBER OF SAMPLES

Table 2-3 presents the numbers of field and quality assurance/quality control (QA/QC) samples proposed for collection during the Round 3 suspended sediment investigation. The number and types of QA/QC samples adhere to guidance presented in the Round 2 QAPP. There will be 72 total field samples. The frequency of QA/QC sample collection is typically one per 20 field samples. Because each quarterly sampling effort will yield fewer than 20 samples, one set of QA/QC samples will be collected during each quarterly event.

## 2.5 SAMPLE ANALYSES

Table 2-4 summarizes the analytes, project-specific reporting limits, and analytical methods for Round 3 sediment trap samples. The list includes the full suite of chemicals of interest that might be present in river sediments. These include metals, semivolatile organic compounds (SVOCs), chlorinated pesticides, polychlorinated biphenyl (PCB) congeners, total petroleum hydrocarbon (TPH), butyltins, volatile organic compounds (VOCs), dioxins and furans, chlorinated herbicides, and hexavalent chromium. The conventional parameters, grain size, total solids, sample water content, total organic carbon (TOC), and specific gravity will be analyzed for all samples. In the event that insufficient sediment volume is collected to allow analysis of samples for the full suite of analytes, a location-specific prioritization of analytes will be determined and proposed for review prior to initiating sample analysis. Table 3-1, referenced in Section 3.7 provides information on the minimum amount of sediment required for all analyses.

The reason for analyzing for all chemicals of interest (COIs), even downstream of a potential source that shows no evidence of a given chemical or group of chemicals, is that the investigation is intended to provide information about all COIs that might enter the Study Area, originate within the Study Area, or exit the Study Area. Excluding a given chemical from analysis at a given location may yield a data gap that introduces additional uncertainty in the assessment of sources and distribution of that particular chemical.

Analytical methods and QC measurements and criteria are based on SW-846 requirements, and EPA and PSEP guidance. Detailed laboratory methods, QA procedures, and QA/QC requirements for sediment samples are described in the Round 2 QAPP (Integral and Windward 2004, in the *Corrective Action Plan: SVOC Analysis of Sediment Core Samples* (Integral 2004c), and in *Round 2 QAPP Addendum 2: PCB Congener Analysis in Sediment Samples* (Integral 2004d). All analyses, except PCB congeners, will be completed by Columbia Analytical Services (CAS). Alta Analytical Laboratory in El Dorado Hills, California, will conduct the PCB congener analysis. Dioxin analyses will be completed at CAS's Houston, Texas facility and the remaining analyses will be completed at CAS's Kelso, Washington facility).

Laboratory QA will be implemented as described in the Round 2 QAPP and in accordance with each of the identified laboratories' respective QA programs, plans, and standard operating procedures (SOPs). Additional information on analytical methods and laboratory QA program plans for each laboratory is provided in the QAPP.

## 2.6 PROJECT SCHEDULE

Actual start dates for the sampling will be determined following EPA approval of this Round 3 Sediment trap FSP. Other conditions that may affect the sampling schedule are weather, river flows, and equipment conditions and availability. Currently, it is anticipated that the Round 3 sediment traps will be deployed in late summer 2006 and visited quarterly until their final recovery approximately one year later in 2007. Reporting of Round 3 sampling results is discussed in Section 4.

# 3.0 ROUND 3 SEDIMENT TRAP SAMPLE COLLECTION AND PROCESSING PROCEDURES

The following sections describe the detailed sampling procedures, record keeping, sample handling, storage, and field QC procedures that will be used during the Round 3 sediment trap investigation. Procedures and details of chain-of-custody and sample shipping are addressed in the Round 2 QAPP (Integral and Windward 2004).

## 3.1 SAMPLING VESSEL

One primary sampling vessel will be used to conduct the suspended sediment sampling program. The vessel will have a deck large enough to accommodate a two person dive team and a contractor field coordinator in addition to the captain and a navigator. The vessel will have enough deck space to accommodate the sampling equipment boxes containing sample jars and other ancillary equipment. The vessel will include a capstan [minimum of 350-lb capacity davit (pulling winch)], navigational lights, anchors, and basic depth sounding equipment. A smaller boat may be used to transport supplies (e.g., sample jars, coolers, and ice), samples, and replacement personnel to and from the primary sampling boat.

## 3.2 STATION POSITIONING AND VERTICAL CONTROL

Latitude and longitude coordinates will be obtained using a differential global positioning system (DGPS). The standard projection method to be used during field activities is Horizontal Datum: North American Datum of 1983 (NAD83), State Plane Coordinate System, Oregon North Zone. The positioning objective is to accurately determine and record the positions of all sampling locations to within ± 2 meters.

Station positioning from the sampling vessel will be accomplished using a DGPS, which consists of a GPS receiver on the sampling platform and a differential receiver located at a horizontal control point. At the control point, the GPS-derived position is compared with the known horizontal location, offsets or biases are calculated, and the correction factors are telemetered to the GPS receiver located on the sampling platform. The GPS system provides the operator with a listing of the time intervals during the day when accuracies are decreased. Avoidance of these time intervals will permit the operator to maintain positioning accuracy to achieve the required accuracy of ±2 meters. The GPS receiver routes latitude and longitude to an integrated navigation system, which displays the platform's position in plan view. Navigation data, such as range and bearing from the target sampling location, are provided at a user-defined scale to guide the sampling platform's pilot to the desired location.

Water depth at each sampling location will be measured using a lead line or fathometer immediately prior to or during the sampling. Vertical measurements will be recorded to the nearest 0.1 foot. Following sampling, water depths will be converted to elevations [feet Columbia River Datum (CRD)] based on the river stage at the time of sampling as recorded at the Morrison Street Bridge.

## 3.3 FIELD DOCUMENTATION

All field activities and observations will be noted in a field logbook during fieldwork. The field logbook will be a bound document with consecutively-numbered pages. Information entered into the field logbook will include personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, or deviations from the Work Plan or FSP) and the reasons for these changes will be documented in the field logbook. Logbook entries will be clearly written with enough detail so that participants can reconstruct events later, if necessary. When field activity is complete, the logbook will be entered into the Portland Harbor project file. Requirements for logbook entries will follow the guidelines specified in the Round 2 QAPP (Integral and Windward 2004).

A sample collection checklist will be produced prior to sampling and completed following sampling operations at each station. The checklist will include station designations, types of samples to be collected (e.g., one jar for metals), and whether blind field replicates or additional sample volumes for laboratory QC analyses are to be collected.

All health and safety entries will be made in the field logbook. Health and safety information will consist of information that does not duplicate information typically entered into the field logbook (e.g., names of personnel and weather conditions). Information specific to health and safety will include, but not be limited to, documenting tailgate meetings, level of personal protective equipment, near misses, accidents, unusual circumstances, and communications with the health and safety manager.

## 3.4 EQUIPMENT AND SUPPLIES

Equipment and supplies will include sediment traps, equipment for supporting dive operations, mixing bowls and utensils, decontamination supplies, sample containers, coolers, logbooks and forms, personal protective equipment, and personal gear. Protective wear (e.g., hard hats and gloves), as required for health and safety of field personnel, will be as specified in the HSP (Integral 2004b).

The analytical laboratories will supply sample containers and preservatives, as well as coolers and packing material. Commercially-available pre-cleaned jars will be used, and the laboratory will maintain a record of certification from the suppliers. The bottle shipment documentation will record batch numbers for the bottles. With this documentation, bottles can be traced to the supplier, and bottle wash analysis results can be reviewed. The bottle wash certificate documentation will be archived in the LWG project file. Field personnel will not obstruct these stickers with sample labels.

Sample containers will be clearly labeled at the time of sampling. Labels will include the project name, sample location and number, sampler's initials, analysis to be performed, date, and time. The scheme used for designating field sample identification numbers is described in Section 3.8.

## 3.5 EQUIPMENT DECONTAMINATION PROCEDURES

The containers for collecting suspended sediment will be polycarbonate or glass tubes with one end open. Sample processing equipment will be stainless steel utensils and mixing bowls. Collection tubes will be decontaminated prior to initial deployment and before each successive quarterly re-deployment. Sediment handling equipment that comes in direct contact with the samples will be decontaminated prior to use at each station and between field replicates. The equipment will be decontaminated in the following manner

- Rinse with site water.
- Wash with brush and Liquinox™ or other phosphate-free detergent.
- Double rinse with distilled water.
- Rinse with methanol.
- Rinse with deionized water.

Sample handling equipment also will be wrapped in aluminum foil following the methanol rinse. To minimize the potential for sample contamination, gloves will be replaced or thoroughly washed using Liquinox™ or another phosphate-free detergent and rinsed with distilled water before and after handling each sample, as appropriate. Rinse waters will be diluted with site water and discarded into the river.

## 3.6 SEDIMENT TRAP DEPLOYMENT AND RECOVERY PROCEDURES

Collecting suspended sediment samples will require four deployment and four recovery operations. The following subsections describe the procedures for performing these operations.

### 3.6.1 Sediment Trap Design

Figure 3-1 shows schematics of the sediment trap construction and deployment. Each sediment trap will consist of an assembly of multiple collection tubes, each placed inside a protective PVC sleeve. The sleeves will be fastened together and will include hardware for mounting and securing on a rebar post driven into the river bottom.

The collection tubes will be approximately 15 cm in diameter and 80 cm long. The tubes may contain a dense salt and sodium azide or formalin preservative if these substances pose no risk to the integrity of sample analyses. Dye may be added to the preservative so visual examination of the recovered trap can determine whether traps have been spilled or flushed.

### 3.6.2 Sediment Trap Deployment

The sediment traps will be installed and retrieved by commercial divers. The divers will drive a rebar support rod vertically into the sediment bed a sufficient distance to ensure the bar will remain in place. A lead line (line on the bottom) 100 feet long will be tied to the rebar, extended downstream of the rebar, and terminated in an anchor to keep the line taut. The lead line will assist divers in locating the sediment trap locations for re-sampling during the project.

The collection tubes will be decontaminated prior to insertion into the protective PVC sleeves and subsequent deployment of the sediment trap assembly. The sediment trap assembly will be lowered using the vessel’s winch. The diver will descend with the trap assembly and control its movement. The diver will affix the trap assembly to the rebar so that the open tops of the cylinders are 3 feet above the mudline elevation. Prior to departing, the diver will inspect the installation for stability and tight connections. In addition, the location of a given sediment trap will be confirmed and recorded in the vessel’s navigation computer.

### 3.6.3 Sediment Trap Recovery

The vessel will occupy the location of a given sediment trap, and one member of the dive team will enter the water. If the diver does not locate the trap immediately, the diver will then move downstream of the location and use a hook or hand to locate the lead line that lies on the bottom downstream of the trap location. The diver will follow the line to the trap.

After locating the sediment trap, the diver will place foil over the top of each collection tube and secure it in place with a rubber band. Sediment traps will be retrieved by loosening the connections that secure the assembly to the rebar and slowly lifting the assembly off the rebar support. The vessel’s winch will be used to slowly hoist the trap assembly to the surface and onto the deck. The diver will guide the trap to the surface to keep the trap vertical as much as possible.

## 3.7 SAMPLE COLLECTION, HANDLING, AND STORAGE

Upon retrieval of the trap assembly, the collection tubes will be removed from the assembly and placed in a stable rack on deck. If it appears that collected sediment has been re-suspended into the tube water column, the crew will allow time for settling before continuing with sediment collection.

The collected sediment in the tubes will first be photographed and inspected for layering or any other salient features that might yield information about influences or events during the deployment. The thickness of sediment accumulated in each tube will be measured as accurately as possible through the tube wall. The thickness measurement will be made at eight equidistant points around the circumference of the tube to account for potential sloping of the accumulated material. This information will be used to estimate the volume of the material present in each tube for later calculation of sediment mass in combination with laboratory data. The accuracy is expected to be within 0.2 cm. After measurements are recorded, the water overlying the sediment surface will be removed using a peristaltic pump or controlled siphon. When the water stream begins to show sediment coloration, pumping will cease.

The collected sediment from all four tubes from a given location will then be placed in a decontaminated stainless-steel mixing container, homogenized using a decontaminated stainless steel spoon until uniform color and texture is achieved, and placed in the appropriate pre-labeled sample containers (certified, pre-cleaned). Details on types of sample jars, preservatives are provided in the Portland Harbor RI/FS Round 2 QAPP (Integral and Windward 2004). Table 3-1 summarizes information about samples containers, preservatives, and holding times for the various analyses. In addition, Table 3-1 provides the minimum amount of sediment required for each analysis in case the recovered volume is less than that required to fill all containers.

The containers will be stored on ice, or refrigerated, until shipment to the appropriate laboratory. Standard chain-of-custody procedures will be observed in the collection, transfer, and shipment of samples.

## 3.8 SAMPLE IDENTIFICATION

All sediment trap samples will be assigned a unique identification number based on a sample designation scheme designed to meet the needs of the field personnel, laboratory and LWG data management, validation chemists, and data users. This code will indicate the project round (Round 3), sampling location, sample type, sampling event, and level of replication/duplication.

Sample identifiers will consist of two to three components separated by dashes. The first component, LW3, identifies the data as belonging to the lower Willamette River RI/FS, Round 3. The second component will begin with the abbreviation “ST” to designate a sediment trap sample, followed by a single-number code that designates the sampling event. The station number will complete the second component.

The following abbreviations will be used to designate the sampling events:

1 = First-quarter sampling event

2 = Second-quarter sampling event

3 = Third-quarter sampling event

4 = Fourth-quarter sampling event

Additional codes may be adopted, if necessary, to reflect sampling equipment requirements. Leading zeros will be used for stations with numbers below 100 for ease of data management and correct sorting.

The third component will be used to code field duplicate samples and splits. A single digit number will be used to indicate field duplicates or splits in the third component of the sample identifiers.

For equipment decontamination blanks, sequential numbers starting at 900 will be assigned instead of station numbers. The sample type code will correspond to the sample type for which the decontamination blank was collected.

Example sample identifiers are:

- LW3-ST1002: sediment trap sample from Station 2 collected at the end of the first quarter.
- LW3-ST3006-1: sediment trap sample from Station 6 collected at the end of the third quarter; field duplicates or splits are associated with this sample.
- LW3-ST3006-2: duplicate or split sediment trap sample from Station 6 collected at the end of the second quarter.
- LW3-ST4902: equipment blank for the surface water samples collected at the end of the fourth quarter.

## 3.9 FIELD QC SAMPLES

Field QC samples are used to assess sample variability (e.g., replicates), evaluate potential sources of contamination (e.g., rinsate, decon, and trip blanks), or confirm proper storage conditions (e.g., temperature blanks). The estimated numbers of field and QC samples are listed in Table 2-3.

# 4.0 REPORTING

## 4.1 LABORATORY CHEMICAL DATA

Validated analytical laboratory data will be provided to EPA in an electronic format within 120 days of completion of each sampling event (e.g., after a sediment trap recovery and sample collection event). A sampling event will generally be considered complete when the last sample of that type described in this FSP has been collected. For sediment trap samples, this would typically be the last sample during a given quarterly sampling episode.

## 4.2 ROUND 3 REPORTING

A field sampling report will be prepared and submitted to EPA within 60 days of completing each Round 3 sample collection effort described in this FSP. The field sampling report will summarize field sampling activities, including sampling locations (maps), requested sample analyses, sample collection methods, and any deviations from the FSP.

Round 3 sediment chemistry results will be reported in tabular format in the Round 3 site characterization summary report that will be submitted to EPA within 120 days of completing the last of the Round 3 sampling and analysis activities.

# 5.0 PROJECT ORGANIZATION

This section presents the organizational structure for sampling and analysis activities associated with the Round 3 suspended sediment investigation, including fieldwork, laboratory analyses, and data management.

## 5.1 TEAM ORGANIZATION AND RESPONSIBILITIES

The Round 3 sediment trap sampling activities will be performed by Anchor, which is one of the contractors retained by the LWG. Integral, another LWG consultant team member, will lead the sample analysis activities, and will provide support for field activities. Information on project organization, coordination, and communication between EPA, LWG, and the consultant team is provided in the RI/FS Work Plan.

### 5.1.1 CERCLA Project Coordinator

Keith Pine (Integral) is the CERCLA Project Coordinator, responsible for managing the Portland Harbor RI and coordinating the overall RI/FS efforts. Mr. Pine will work closely with the Sampling and Analysis Coordinator to ensure that the objectives of the Round 3 field investigation are achieved. In the event that changes in the FSP are needed, he will discuss proposed changes with the Sampling and Analysis Coordinators and EPA's Project Manager or other designated EPA staff. Changes to the FSP will not be made without prior approval from the EPA Project Manager unless conditions in the field or laboratory require immediate response.

### 5.1.2 Sampling Coordinator

Dennis Hanzlick (Anchor) will be the Sampling Coordinator, responsible for all facets of the sampling program. He will report directly to the CERCLA Project Coordinator. His specific responsibilities include the following:

- Coordinate the field and laboratory analyses with the Analysis Coordinator.
- Provide solutions to problems if they occur.

### 5.1.3 Analysis Coordinator

Laura Jones (Integral) will be the Analysis Coordinator, responsible for all facets of the sample analysis program. She will report directly to the CERCLA Project Coordinator. Her specific responsibilities include the following:

- Coordinate the field and laboratory analyses with the Sampling Coordinator.

- Ensure that laboratory capacity is sufficient to undertake the required analyses in a timely manner.
- Ensure adherence to the schedule by tracking sampling, laboratory analysis, validation, and data management tasks.
- Provide solutions to problems if they occur.
- Inform the CERCLA Project Coordinator and the EPA Project Manager of any decisions that involve changes to the FSP and QAPP.

### 5.1.4 Field Coordinator

Shawn Hinz (Anchor) will be the Field Coordinator (FC) and will be responsible for directing all field sampling tasks and implementing health and safety program requirements. Specifically, the FC will be responsible for the following:

- Oversee the planning and coordination for all sampling efforts.
- Oversee all aspects of the sampling to ensure that the appropriate procedures and methods are used.
- Correct any work practices or conditions that may result in personnel injury or exposure to hazardous materials.
- Determine appropriate personal protection levels and necessary clothing and equipment, and oversee its proper use.
- Verify that the field crew are aware of the provisions of the HSP and are instructed in safe work practices.
- Verify that the field crew has received the required safety training.
- Ensure that all activities adhere to the FSP and QAPP.
- Inform the field coordinator of any decisions that involve changes to the FSP and QAPP.
- Mobilize and prepare for fieldwork.
- Ensure sample custody, including chain-of-custody.

If necessary, the FC may delegate some individual responsibilities to qualified personnel. If changes to the FSP are warranted, the FC will immediately notify the Sampling and Analysis Coordinator.

### 5.1.5 Field Crews

Field staff for all sampling events will be provided by Anchor and Integral. The operators of sampling vessels and equipment, as appropriate, will supply additional staff. The field crew will include divers to perform deployment and recovery operations and technicians to prepare the sediment traps and process and handle the collected sediments. It is the responsibility of all field staff to report any problems or potential changes to the FSP to the FC.

### 5.1.6 Quality Assurance Managers

Quality assurance managers have been assigned for all aspects of Round 3 sampling and analysis. All quality assurance managers for Round 3 will report to the Sampling and Analysis Coordinator.

#### Field QA Manager

Shawn Hinz (Anchor), the FC, will also serve as the QA manager for all Round 3 field sampling activities. He will oversee all aspects of the sampling events to ensure that the appropriate procedures and methods are used.

#### Chemistry QA Manager

Laura Jones (Integral), the Analysis Coordinator, will also be the QA manager for analytical chemistry. She will perform laboratory oversight for the analytical laboratories and will direct the quality assurance review of chemical data.

### 5.1.7 Data Management

Tom Schulz (Integral) will have primary responsibility for data management. Integral will continue to use the EQuIS database as the primary repository of environmental data. Mr. Schulz works directly with this database and is familiar with its structure and operation. Michelle McClelland, Anchor Environmental, will serve as Anchor’s database manager and will coordinate with Mr. Schulz to obtain updates of the database for Anchor’s use in assembling results tables.

### 5.1.8 Laboratory Services

Laboratory services will be used during Round 3 for chemical analysis. All of the selected laboratories will have demonstrated to the LWG that they have acceptable performance records and are capable of performing the analyses required. Laboratory qualifications and SOPs are provided in the Round 2 QAPP and Addenda.

## 5.2 COMMUNICATION/INFORMATION FLOW

During field operations, the field staff will report to the FC (Shawn Hinz or designee). The chemical laboratories will report to the Chemistry QA Manager, (Laura Jones). The FC, will report to the Sampling Coordinator (Dennis Hanzlick). Issues requiring the attention of the LWG or EPA will be discussed with the CERCLA Project Coordinator (Keith Pine), Mr. Pine or one of the Sampling and Analysis Coordinators will communicate the issues to the LWG. To the extent possible, official communications between EPA and the LWG will occur through their respective project managers.

Field change request forms will be completed for any change to the FSP or QAPP; EPA approval will be required for all changes. Any field staff or manager may request changes. The change request form should be submitted to the Sampling Coordinator. If the Sampling Coordinator approves the change, he will submit the form to the CERCLA Project Coordinator. The CERCLA Project Coordinator or the Sampling Coordinator will notify the LWG and will submit the forms to the EPA Project Manager for approval. If circumstances require immediate action, verbal authorization may be obtained and the change may be implemented, but a field change request form must still be completed and submitted as soon as possible to document the change and ensure that all managers are informed.

## 5.3 COORDINATION WITH EPA

### 5.3.1 Field Sampling Notification

The CERCLA Project Coordinator or the Sampling Coordinator will notify the EPA Project Manager and tribal representatives at least one week prior to beginning field activities so that EPA can schedule any necessary oversight tasks. EPA's Project Manager will contact the CERCLA Project Coordinator and the tribal representatives to coordinate these activities and determine appropriate logistics. The CERCLA Project Coordinator will notify EPA, in writing, when field activities are completed.

### 5.3.2 Split Samples

Split and/or verification samples for chemical testing can be provided to EPA or its designated representative. EPA's Project Manager should contact the CERCLA Project Coordinator at least three days in advance to coordinate this activity and determine appropriate logistics. The Sampling Coordinator will notify EPA or its designated representative if low recovery of sediment in the sediment traps occurs and there is not adequate sample mass to generate sample splits. It is recommended that split samples be taken at those stations where blind field replicates are taken so that EPA's comparison samples are evaluated relative to the field and analytical variability measured by the LWG project team.

# 6.0 REFERENCES

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# Tables

Table 2.1. General Information for Proposed Sediment Trap Sample Locations.

| Station ID | River Mile | Station Location | Rationale for Location |
|---|---|---|---|
| ST001 | Mile 1.9 | East Side of River Immediately Downstream of the Study Area | To collect sediment trap mass and assess the chemical concentrations of suspended sediment downstream of the Study Area; Evaluate cross-channel comparison with ST002. |
| ST002 | Mile 1.9 | West Side of River Immediately Downstream of the Study Area | To collect sediment trap mass and assess the chemical concentrations of suspended sediment downstream of the Study Area; Evaluate cross-channel comparison with ST001. |
| ST003 | Mile 3 | Multnomah Mid-Channel | To collect sediment trap mass and assess the chemical concentrations of suspended sediment load in the Multnomah Channel. |
| ST004 | Mile 6 | East Side of River near Surface Water Sampling Transect | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in the middle of the study area; located downstream of the surface water mid-stream transect (W011) for comparison to surface water concentrations; Evaluate cross-channel comparison with ST005. |
| ST005 | Mile 6 | West Side of River near Surface Water Sampling Transect | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in the middle of the study area; located downstream of the surface water mid-stream transect (W011) for comparison to surface water concentrations; Evaluate cross-channel comparison with ST004. |
| ST006 | Mile 8.8 | Swan Island Lagoon | To collect sediment trap mass and assess chemical concentrations of sediment from a quiescent, low-energy environment |
| ST007 | Mile 11.5 | East Side of River Near the Upstream Terminus of the Navigation Channel | To collect sediment trap mass and assess the chemical concentrations of suspended sediment upstream of the Study Area; Evaluate cross-channel comparison with ST008. |
| ST008 | Mile 11.5 | West Side of River Near the Upstream Terminus of the Navigation Channel | To collect sediment trap mass and assess the chemical concentrations of suspended sediment upstream of the Study Area; Evaluate cross-channel comparison with ST007. |
| ST009 | Mile 15.7 | Upstream end of the Channel around the East Side of Ross Island | To collect sediment trap mass and assess the chemical concentrations of suspended sediment upstream of the Study Area and downtown Portland urban area; Evaluate cross-channel comparison with ST010. |

Table 2.1. General Information for Proposed Sediment Trap Sample Locations.

| Station ID | River Mile | Station Location | Rationale for Location |
|---|---|---|---|
| ST010 | Mile 15.7 | Upstream end of the Channel around the West Side of Ross Island | To collect sediment trap mass and assess the chemical concentrations of suspended sediment upstream of the Study Area and downtown Portland urban area; Evaluate cross-channel comparison with ST009. |
| ST011 | Mile 3.5 | East side of river offshore of Time Oil Northwest Terminal | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in a potential depositional area of the Study Area. |
| ST012 | Mile 4.6 | West side of river offshore of Columbia River Sand & Gravel and Linnton Plywood Association | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in a potential depositional area of the Study Area. |
| ST013 | Mile 6.8 | East side of river in Willamette Cove | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in a potential depositional area of the Study Area. |
| ST014 | Mile 7.8 | West side of river in the vicinity of dock facilities for multiple oil companies. | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in a potential depositional area of the Study Area. |
| ST015 | Mile 9.7 | West side of river - Port of Portland Terminal 2/Fireboat Location | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in a potential depositional area of the Study Area. |
| ST016 | Mile 9.9 | East side of river. | To collect sediment trap mass and assess the chemical concentrations of suspended sediment in a potential depositional area of the Study Area. |

Table 2-2. Target Coordinates for Sediment Trap Sample Locations.

| Sediment Trap Location | Northing | Easting | Latitude (°N) | Longitude (°W) |
|---|---|---|---|---|
| ST001 | 725222 | 7617870 | 45 37.9938 | 122 47.0506 |
| ST002 | 726356 | 7616862 | 45 38.1756 | 122 47.2944 |
| ST003 | 720286 | 7613456 | 45 37.1613 | 122 48.0525 |
| ST004 | 707241 | 7623456 | 45 35.0619 | 122 45.6228 |
| ST005 | 706567 | 7622774 | 45 34.9479 | 122 45.7782 |
| ST006 | 699881 | 7635405 | 45 33.9057 | 122 42.7763 |
| ST007 | 688135 | 7645010 | 45 32.0164 | 122 40.4529 |
| ST008 | 687984 | 7644278 | 45 31.9883 | 122 40.6232 |
| ST009 | 667005 | 7647588 | 45 28.5518 | 122 39.7171 |
| ST010 | 667212 | 7646543 | 45 28.5813 | 122 39.9627 |
| ST011 | 718164 | 7617296 | 45 36.8302 | 122 47.1383 |
| ST012 | 712698 | 7618279 | 45 35.9356 | 122 46.8717 |
| ST013 | 705423 | 7626969 | 45 34.7790 | 122 44.7880 |
| ST014 | 700469 | 7629377 | 45 33.9751 | 122 44.1918 |
| ST015 | 694607 | 7637564 | 45 33.0478 | 122 42.2370 |
| ST016 | 694895 | 7639305 | 45 33.1030 | 122 41.8312 |

Oregon State Plane North - feet; NAD 83

Table 2-3. Summary of Numbers of Round 3 Field and QC Samples for the Sediment Trap Study[1].

| Sample Type | Field Samples | Blind Field Sample Splits[1] | Blind Field Replicates | Field Rinsate Blanks | Total Number of Field Samples |
|---|---|---|---|---|---|
| ***Sediment - Surface*** | | | | | |
| SVOCs | 64 | 4 | 4 | 4 | 72 |
| Metals | 64 | 4 | 4 | 4 | 72 |
| Pesticides | 64 | 4 | 4 | 4 | 72 |
| PCBs | 64 | 4 | 4 | 4 | 72 |
| Total Petroleum Hydrocarbons | 64 | 4 | 4 | 4 | 72 |
| Butyltins | 64 | 4 | 4 | 4 | 72 |
| Volatile Organic Compounds | 64 | 4 | 4 | 4 | 72 |
| Dioxins/Furans | 64 | 4 | 4 | 4 | 72 |
| Chlorinated Herbicides | 64 | 4 | 4 | 4 | 72 |
| Hexavalent Chromium | 64 | 4 | 4 | 4 | 72 |

[1]All samples will be analyzed for total solids, grain size, total organic carbon, and specific gravity. Replicates and split samples will be analyzed for conventionals and chemicals of concern. Conventionals are excluded from the analysis of rinsate blanks. Field QC sample numbers are based on the assumption that there will be four field episodes and one of each type of field QC sample per episode. The EPA blind field sample splits are not tallied in this table.

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| **Conventional Analyses** | | | | |
| Total solids (percent of whole weight) | -- | * | 0.01 | 0.01 |
| Grain size (percent)[d] | -- | * | 0.1 | 0.1 |
| Total sulfides (mg/kg) | -- | * | 0.1 | 0.2 |
| Ammonia (mg/kg) | 7664-41-7 | * | 0.05 | 0.1 |
| Total organic carbon (percent) | -- | * | 0.02 | 0.05 |
| **Geotechnical characteristics** | | | | |
| Specific gravity (g/cc) | -- | * | -- | 0.01 |
| Atterberg limits (percent moisture) | -- | * | -- | 0.1 |
| **Metals** | | | **mg/kg dry wt** | |
| Aluminum | 7429-90-5 | * | 2.0 | 2.0 |
| Antimony | 7440-36-0 | * | 0.02 | 0.05 |
| Arsenic | 7440-38-2 | * | 0.05 | 0.1 |
| Cadmium | 7440-43-9 | * | 0.006 | 0.02 |
| Chromium | 7440-47-3 | * | 0.04 | 0.2 |
| Copper | 7440-50-8 | * | 0.07 | 0.1 |
| Lead | 7439-92-1 | * | 0.02 | 0.05 |
| Mercury | 7439-97-6 | * | 0.01 | 0.02 |
| Nickel | 7440-02-0 | * | 0.03 | 0.2 |
| Selenium | 7782-49-2 | * | 0.05 | 0.1 |
| Silver | 7440-22-4 | * | 0.02 | 0.02 |
| Zinc | 7440-66-6 | * | 0.1 | 0.5 |
| Hexavalent chromium | 18540-29-9 | * | 0.2 | 0.5 |
| **Petroleum hydrocarbons** | | | **mg/kg dry wt** | |
| Gasoline-range petroleum hydrocarbons | -- | * | 3.2 | 10 |
| Diesel-range petroleum hydrocarbons | -- | * | 7.1 | 25 |
| Motor oil-range petroleum hydrocarbons | -- | * | 4.6 | 100 |
| **Butyltins** | | | **µg/kg dry wt** | |
| Monobutyltin | 78763-54-9 | * | 0.071 | 1 |
| Dibutyltin | 14488-53-0 | * | 0.041 | 1 |
| Tributyltin | 36643-28-4 | **0.08** | 0.16 | 1 |
| Tetrabutyltin | 1461-25-2 | * | 0.12 | 1 |
| **Chlorinated Herbicides and Pentachlorophenol** | | | **µg/kg dry wt** | |
| Dalapon | 75-99-0 | * | tbd | 5 |
| Dicamba | 1918-00-9 | * | tbd | 5 |
| MCPA | 94-74-6 | * | tbd | 5 |
| Dichlorprop | 120-36-5 | * | tbd | 5 |
| 2,4-D | 94-75-7 | **2.8** | tbd[e] | 5 |
| 2,4,5-TP (Silvex) | 93-72-1 | **2.2** | tbd[e] | 8 |
| 2,4,5-T | 93-76-5 | **2.8** | tbd[e] | 8 |
| 2,4-DB | 94-82-6 | **2.2** | tbd[e] | 5 |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| **Analyte** | **CAS number** | **ACG[a]** | **MDL[b]** | **MRL[c]** |
|---|---|---|---|---|
| Dinoseb | 88-85-7 | * | tbd | 8 |
| MCPP | 93-65-2 | * | tbd | 5 |
| Pentachlorophenol | 87-86-5 | **0.58** | tbd[e] | 5 |
| **Organochlorine Pesticides and Selected SVOCs** | | | **µg/kg dry wt** | |
| 2,4'-DDD | 53-19-0 | * | tbd | 0.2 |
| 2,4'-DDE | 3424-82-6 | * | tbd | 0.2 |
| 2,4'-DDT | 789-02-6 | * | tbd | 0.2 |
| 4,4'-DDD | 72-54-8 | **0.083** | tbd | 0.2 |
| 4,4'-DDE | 72-55-9 | **0.0588** | tbd | 0.2 |
| 4,4'-DDT | 50-29-3 | **0.0588** | tbd | 0.2 |
| Total DDT | | ***** | tbd | |
| Aldrin | 309-00-2 | **0.00038** | tbd | 0.2 |
| a - BHC | 319-84-6 | **0.001** | tbd | 0.2 |
| b - BHC | 319-85-7 | **0.0036** | tbd | 0.2 |
| d - BHC | 319-86-8 | * | tbd | 0.2 |
| g - BHC (Lindane) | 58-89-9 | **0.005** | tbd | 0.2 |
| a - Chlordane | 5103-71-9 | * | tbd | 0.2 |
| g - Chlordane | 5103-74-2 | * | tbd | 0.2 |
| Oxychlordane | 27304-13-8 | * | tbd | 0.2 |
| *cis* - Nonachlor | 5103-73-1 | * | tbd | 0.2 |
| *trans* - Nonachlor | 39765-80-5 | * | tbd | 0.2 |
| Total chlordane[f] | | **0.057** | tbd | |
| Dieldrin | 60-57-1 | **0.0004** | tbd | 0.2 |
| Endosulfan I | 959-98-8 | 1.7 | tbd | 0.2 |
| Endosulfan II | 33213-65-9 | * | tbd | 0.2 |
| Endosulfan sulfate | 1031-07-8 | * | tbd | 0.2 |
| Endrin | 72-20-8 | **0.084** | tbd | 0.2 |
| Endrin aldehyde | 7421-93-4 | * | tbd | 0.2 |
| Endrin ketone | 53494-70-5 | * | tbd | 0.2 |
| Heptachlor | 76-44-8 | **0.0014** | tbd | 0.2 |
| Heptachlor epoxide | 1024-57-3 | **0.0007** | tbd | 0.2 |
| Methoxychlor | 72-43-5 | 1.4 | tbd | 0.2 |
| Mirex | 2385-85-5 | **0.056** | tbd | 0.2 |
| Toxaphene | 8001-35-2 | **0.0059** | tbd | 20 |
| Hexachlorobenzene | 118-74-1 | 0.33 | tbd | tbd |
| Hexachlorobutadiene | 87-68-3 | 0.6 | tbd | tbd |
| Hexachloroethane | 67-72-1 | 2.0 | tbd | tbd |
| **PCB Aroclors** | | | **µg/kg dry wt** | |
| Aroclor 1016 | 12674-11-2 | * | tbd | 4 |
| Aroclor 1221 | 11104-28-2 | * | tbd | 4 |
| Aroclor 1232 | 11141-16-5 | * | tbd | 4 |
| Aroclor 1242 | 53469-21-9 | **0.004** | tbd | 4 |
| Aroclor 1248 | 12672-29-6 | **0.004** | tbd | 4 |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| **Analyte** | **CAS number** | **ACG[a]** | **MDL[b]** | **MRL[c]** |
|---|---|---|---|---|
| Aroclor 1254 | 11097-69-1 | **0.004** | tbd | 4 |
| Aroclor 1260 | 11096-82-5 | **0.004** | tbd | 4 |
| Aroclor 1262 | 37324-23-5 | * | tbd | 4 |
| Aroclor 1268 | 11100-14-4 | * | tbd | 4 |
| **Volatile Organic Compounds** | | | **µg/kg dry wt** | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | * | tbd | 1 |
| 1,1,1-Trichloroethane | 71-55-6 | * | tbd | 1 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | * | tbd | 1 |
| 1,1,2-Trichloroethane | 79-00-5 | * | tbd | 1 |
| 1,1-Dichloroethane | 75-34-3 | * | tbd | 1 |
| 1,2,3-Trichloropropane | 96-18-4 | * | tbd | 1 |
| 1,2-Dichloroethane | 107-06-2 | * | tbd | 1 |
| 1,2-Dichloropropane | 78-87-5 | * | tbd | 1 |
| 1,4-Dichlorobenzene | 106-46-7 | 2.0 | tbd | 1 |
| 2-Butanone | 78-93-3 | * | tbd | 4 |
| 2-Chloroethyl Vinyl Ether | 110-75-8 | * | tbd | 2 |
| 2-Hexanone | 591-78-6 | * | tbd | 4 |
| 4-Methyl-2-Pentanone | 108-10-1 | * | tbd | 4 |
| Acetone | 67-64-1 | * | tbd | 4 |
| Acrolein | 107-02-8 | * | tbd | 20 |
| Acrylonitrile | 107-13-1 | * | tbd | 4 |
| Bromochloromethane | 74-97-5 | * | tbd | 1 |
| Bromodichloromethane | 75-27-4 | * | tbd | 1 |
| Bromoethane | 74-96-4 | * | tbd | NE |
| Bromoform | 75-25-2 | * | tbd | 1 |
| Bromomethane | 74-83-9 | * | tbd | 1 |
| Carbon Disulfide | 75-15-0 | * | tbd | 1 |
| Carbon Tetrachloride | 56-23-5 | * | tbd | 1 |
| Chlorobenzene | 108-90-7 | * | tbd | 1 |
| Chlorodibromomethane | 124-48-1 | * | tbd | 1 |
| Chloroethane | 75-00-3 | * | tbd | 1 |
| Chloroform | 67-66-3 | * | tbd | 1 |
| Chloromethane | 74-87-3 | * | tbd | 1 |
| *cis* - 1,3-Dichloropropene | 10061-01-5 | * | tbd | 1 |
| Dibromomethane | 74-95-3 | * | tbd | 1 |
| Dichlorodifluoromethane | 75-71-8 | * | tbd | 1 |
| Iodomethane | 74-88-4 | * | tbd | 4 |
| Isopropyl benzene | 98-82-8 | * | tbd | 4 |
| Methylene chloride | 75-09-2 | * | tbd | 2 |
| Naphthalene | 91-20-3 | 23 | tbd | 4 |
| Styrene | 100-42-5 | * | tbd | 1 |
| *trans* -1,4-Dichloro-2-butene | 110-57-6 | * | tbd | 4 |
| Trichlorofluoromethane | 75-69-4 | * | tbd | 1 |
| Vinyl Acetate | 108-05-4 | * | tbd | 4 |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| **Analyte** | **CAS number** | **ACG**[a] | **MDL**[b] | **MRL**[c] |
|---|---|---|---|---|
| 1,1-Dichloroethene | 75-35-4 | * | tbd | 1 |
| Benzene | 71-43-2 | * | tbd | 1 |
| Ethyl Benzene | 100-41-4 | * | tbd | 1 |
| *m,p* -Xylene | 179601-23-1 | * | tbd | 1 |
| Methyl-*t* -butyl ether (MTBE) | 1634-04-4 | * | tbd | 1 |
| *o* -Xylene | 95-47-6 | * | tbd | 1 |
| Tetrachloroethene | 127-18-4 | * | tbd | 1 |
| Toluene | 108-88-3 | * | tbd | 1 |
| *trans* -1,2-Dichloroethene | 156-60-5 | * | tbd | 1 |
| *trans* -1,3-Dichloropropene | 10061-02-6 | * | tbd | 1 |
| Trichloroethene | 79-01-6 | * | tbd | 1 |
| Vinyl Chloride | 75-01-4 | * | tbd | 1 |
| **Semivolatile Organic Compounds** | | | **µg/kg dry wt** | |
| **Halogenated Compounds** | | | | |
| 1,2-Dichlorobenzene | 95-50-1 | 184 | tbd | 20 |
| 1,3-Dichlorobenzene | 541-73-1 | * | tbd | 20 |
| 1,4-Dichlorobenzene[g] | 106-46-7 | **2.0** | tbd | 20 |
| 1,2,4-Trichlorobenzene | 120-82-1 | * | tbd | 20 |
| Hexachlorobenzene[h] | 118-74-1 | **0.3** | tbd | 100 |
| 2-Chloronaphthalene | 91-58-7 | * | tbd | 20 |
| Hexachloroethane[h] | 67-72-1 | **2.0** | tbd | 5 |
| Hexachlorobutadiene[h] | 87-68-3 | **0.6** | tbd | 100 |
| Hexachlorocyclopentadiene | 77-47-4 | * | tbd | 100 |
| 2,2'-oxybis(1-chloropropane) | 108-60-1 | * | tbd | 20 |
| Bis-(2-chloroethoxy) methane | 111-91-1 | * | tbd | 20 |
| Bis-(2-chloroethyl) ether | 111-44-4 | * | tbd | 40 |
| 4-Chlorophenyl-phenyl ether | 7005-72-3 | * | tbd | 20 |
| 4-bromophenyl-phenyl ether | 101-55-3 | * | tbd | 20 |
| 3,3’-Dichlorbenzidine | 91-94-1 | * | tbd | 100 |
| 4-Chloroaniline | 106-47-8 | * | tbd | tbd |
| **Organonitrogen Compounds** | | | | |
| Nitrobenzene | 98-95-3 | * | tbd | 20 |
| Aniline | 62-53-3 | * | tbd | 20 |
| 2-Nitroaniline | 88-74-4 | * | tbd | 20 |
| 3-Nitroaniline | 99-09-2 | * | tbd | 120 |
| 4-Nitroaniline | 100-01-6 | * | tbd | 60 |
| n-Nitrosodimethylamine | 62-75-9 | **0.0073** | tbd | 100 |
| n-Nitroso-di-n-propylamine | 621-64-7 | **0.053** | tbd | 20 |
| n-Nitrosodiphenylamine | 86-30-6 | * | tbd | 20 |
| 1,2-Diphenylhydrazine | 122-66-7 | **0.0025** | tbd | tbd |
| 2,4-Dinitrotoluene | 121-14-2 | * | tbd | 100 |
| 2,6-Dinitrotoluene | 606-20-2 | * | tbd | 100 |
| Carbazole | 86-74-8 | 6.12 | tbd | 5 |
| **Oxygen-Containing Compounds** | | | | |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| Benzoic Acid | 65-85-0 | * | tbd | 200 |
| Benzyl Alcohol | 100-51-6 | * | tbd | 20 |
| Dibenzofuran | 132-64-9 | 8.2 | tbd | 5 |
| Isophorone | 78-59-1 | * | tbd | 20 |
| **Phenols and Substituted Phenols** | | | | |
| Phenol | 108-95-2 | 3146 | tbd | 20 |
| 2-Methylphenol | 95-48-7 | * | tbd | 20 |
| 4-Methylphenol | 106-44-5 | 26 | tbd | 20 |
| 2,4-Dimethylphenol | 105-67-9 | * | tbd | 20 |
| 2-Chlorophenol | 95-57-8 | 26 | tbd | 20 |
| 2,4-Dichlorophenol | 120-83-2 | **16** | tbd | 60 |
| 2,4,5-Trichlorophenol | 95-95-4 | 524 | tbd | 100 |
| 2,4,6-Trichlorophenol | 88-06-2 | **1.8** | tbd | 100 |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | 157 | tbd | 100 |
| 2,3,4,5- and 2,3,5,6-Tetrachlorophenol | 4901-51-3; 935-95-5 | 157 | tbd | 100 |
| Pentachlorophenol[i] | 87-86-5 | **0.58** | tbd | 34 |
| 4-Chloro-3-methylphenol | 59-50-7 | * | tbd | 40 |
| 2-Nitrophenol | 88-75-5 | * | tbd | 100 |
| 4-Nitrophenol | 100-02-7 | * | tbd | 100 |
| 2,4-Dinitrophenol | 51-28-5 | * | tbd | 200 |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | * | tbd | 200 |
| **Phthalate Esters** | | | | |
| Dimethylphthalate | 131-11-3 | 20000 | tbd | 20 |
| Diethylphthlalate | 84-66-2 | * | tbd | 20 |
| Di-n-butylphthalate | 84-74-2 | 204 | tbd | 20 |
| Butylbenzylphthalate | 85-68-7 | 400 | tbd | 20 |
| Di-n-octylphthalate | 117-84-0 | 40.9 | tbd | 20 |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | **3.4** | tbd | 20 |
| **Polycyclic Aromatic Hydrocarbons** | | | | |
| Naphthalene | 91-20-3 | 24 | tbd | 20 |
| 2-Methylnaphthalene | 91-57-6 | * | tbd | 20 |
| Acenaphthylene | 208-96-8 | * | tbd | 20 |
| Acenaphthene | 83-32-9 | 72 | tbd | 20 |
| Fluorene | 86-73-7 | 48 | tbd | 20 |
| Phenanthrene | 85-01-8 | * | tbd | 20 |
| Anthracene | 120-12-7 | 360 | tbd | 20 |
| Fluoranthene | 206-44-0 | 48 | tbd | 20 |
| Pyrene | 129-00-0 | 36 | tbd | 20 |
| Benzo(a)anthracene | 56-55-3 | **0.038** | tbd | 5 |
| Chrysene | 218-01-9 | **3.8** | tbd | 5 |
| Benzo(b)fluoranthene | 205-99-2 | **0.038** | tbd | 5 |
| Benzo(k)fluoranthene | 207-08-9 | **0.38** | tbd | 5 |
| Benzo(a)pyrene | 50-32-8 | **0.0038** | tbd | 5 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | **0.038** | tbd | 5 |
| Dibenz(a,h)anthracene | 53-70-3 | **0.0038** | tbd | 5 |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| **Analyte** | **CAS number** | **ACG**[a] | **MDL**[b] | **MRL**[c] |
|---|---|---|---|---|
| Benzo(g,h,i)perylene | 191-24-2 | * | tbd | 5 |
| **PCB congeners** | | | **pg/g dry wt**[j,k] | |
| 2-MoCB | PCB-1 | tbd | tbd | tbd |
| 3-MoCB | PCB-2 | tbd | tbd | tbd |
| 4-MoCB | PCB-3 | tbd | tbd | tbd |
| 2,2'-DiCB | PCB-4 | tbd | tbd | tbd |
| 2,3-DiCB | PCB-5 | tbd | tbd | tbd |
| 2,3'-DiCB | PCB-6 | tbd | tbd | tbd |
| 2,4-DiCB | PCB-7 | tbd | tbd | tbd |
| 2,4'-DiCB | PCB-8 | tbd | tbd | tbd |
| 2,5-DiCB | PCB-9 | tbd | tbd | tbd |
| 2,6-DiCB | PCB-10 | tbd | tbd | tbd |
| 3,3'-DiCB | PCB-11 | tbd | tbd | tbd |
| 3,4-DiCB | PCB-12 | tbd | tbd | tbd |
| 3,4'-DiCB | PCB-13 | tbd | tbd | tbd |
| 3,5-DiCB | PCB-14 | tbd | tbd | tbd |
| 4,4'-DiCB | PCB-15 | tbd | tbd | tbd |
| 2,2',3-TrCB | PCB-16 | tbd | tbd | tbd |
| 2,2',4-TrCB | PCB-17 | tbd | tbd | tbd |
| 2,2',5-TrCB | PCB-18 | tbd | tbd | tbd |
| 2,2',6-TrCB | PCB-19 | tbd | tbd | tbd |
| 2,3,3'-TrCB | PCB-20 | tbd | tbd | tbd |
| 2,3,4-TrCB | PCB-21 | tbd | tbd | tbd |
| 2,3,4'-TrCB | PCB-22 | tbd | tbd | tbd |
| 2,3,5-TrCB | PCB-23 | tbd | tbd | tbd |
| 2,3,6-TrCB | PCB-24 | tbd | tbd | tbd |
| 2,3',4-TrCB | PCB-25 | tbd | tbd | tbd |
| 2,3',5-TrCB | PCB-26 | tbd | tbd | tbd |
| 2,3',6-TrCB | PCB-27 | tbd | tbd | tbd |
| 2,4,4'-TrCB | PCB-28 | tbd | tbd | tbd |
| 2,4,5-TrCB | PCB-29 | tbd | tbd | tbd |
| 2,4,6-TrCB | PCB-30 | tbd | tbd | tbd |
| 2,4',5-TrCB | PCB-31 | tbd | tbd | tbd |
| 2,4',6-TrCB | PCB-32 | tbd | tbd | tbd |
| 2',3,4-TrCB | PCB-33 | tbd | tbd | tbd |
| 2',3,5-TrCB | PCB-34 | tbd | tbd | tbd |
| 3,3',4-TrCB | PCB-35 | tbd | tbd | tbd |
| 3,3',5-TrCB | PCB-36 | tbd | tbd | tbd |
| 3,4,4'-TrCB | PCB-37 | tbd | tbd | tbd |
| 3,4,5-TrCB | PCB-38 | tbd | tbd | tbd |
| 3,4',5-TrCB | PCB-39 | tbd | tbd | tbd |
| 2,2',3,3'-TeCB | PCB-40 | tbd | tbd | tbd |
| 2,2',3,4-TeCB | PCB-41 | tbd | tbd | tbd |
| 2,2',3,4'-TeCB | PCB-42 | tbd | tbd | tbd |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| 2,2',3,5-TeCB | PCB-43 | tbd | tbd | tbd |
| 2,2',3,5'-TeCB | PCB-44 | tbd | tbd | tbd |
| 2,2',3,6-TeCB | PCB-45 | tbd | tbd | tbd |
| 2,2',3,6'-TeCB | PCB-46 | tbd | tbd | tbd |
| 2,2',3,4'-TeCB | PCB-47 | tbd | tbd | tbd |
| 2,2',4,5-TeCB | PCB-48 | tbd | tbd | tbd |
| 2,2',4,5'-TeCB | PCB-49 | tbd | tbd | tbd |
| 2,2',4,6-TeCB | PCB-50 | tbd | tbd | tbd |
| 2,2',4,6'-TeCB | PCB-51 | tbd | tbd | tbd |
| 2,2',5,5'-TeCB | PCB-52 | tbd | tbd | tbd |
| 2,2',5,6'-TeCB | PCB-53 | tbd | tbd | tbd |
| 2,2',6,6'-TeCB | PCB-54 | tbd | tbd | tbd |
| 2,3,3',4'-TeCB | PCB-55 | tbd | tbd | tbd |
| 2,3,3',4'-TeCB | PCB-56 | tbd | tbd | tbd |
| 2,3,3',5-TeCB | PCB-57 | tbd | tbd | tbd |
| 2,3,3',5'-TeCB | PCB-58 | tbd | tbd | tbd |
| 2,3,3',6-TeCB | PCB-59 | tbd | tbd | tbd |
| 2,3,4,4'-TeCB | PCB-60 | tbd | tbd | tbd |
| 2,3,4,5-TeCB | PCB-61 | tbd | tbd | tbd |
| 2,3,4,6-TeCB | PCB-62 | tbd | tbd | tbd |
| 2,3,4',5-TeCB | PCB-63 | tbd | tbd | tbd |
| 2,3,4',6-TeCB | PCB-64 | tbd | tbd | tbd |
| 2,3,5,6-TeCB | PCB-65 | tbd | tbd | tbd |
| 2,3',4,4'-TeCB | PCB-66 | tbd | tbd | tbd |
| 2,3',4,5-TeCB | PCB-67 | tbd | tbd | tbd |
| 2,3',4,5'-TeCB | PCB-68 | tbd | tbd | tbd |
| 2,3',4,6-TeCB | PCB-69 | tbd | tbd | tbd |
| 2,3',4',5-TeCB | PCB-70 | tbd | tbd | tbd |
| 2,3',4',6-TeCB | PCB-71 | tbd | tbd | tbd |
| 2,3',5,5'-TeCB | PCB-72 | tbd | tbd | tbd |
| 2,3',5',6-TeCB | PCB-73 | tbd | tbd | tbd |
| 2,4,4',5-TeCB | PCB-74 | tbd | tbd | tbd |
| 2,4,4',6-TeCB | PCB-75 | tbd | tbd | tbd |
| 2',3,4',5-TeCB | PCB-76 | tbd | tbd | tbd |
| 3,3',4,4'-TeCB | PCB-77 | tbd | tbd | tbd |
| 3,3',4,5-TeCB | PCB-78 | tbd | tbd | tbd |
| 3,3',4,5'-TeCB | PCB-79 | tbd | tbd | tbd |
| 3,3',5,5'-TeCB | PCB-80 | tbd | tbd | tbd |
| 3,4,4',5-TeCB | PCB-81 | tbd | tbd | tbd |
| 2,2',3,3',4-PeCB | PCB-82 | tbd | tbd | tbd |
| 2,2',3,3',5-PeCB | PCB-83 | tbd | tbd | tbd |
| 2,2',3,3',6-PeCB | PCB-84 | tbd | tbd | tbd |
| 2,2',3,4,4'-PeCB | PCB-85 | tbd | tbd | tbd |
| 2,2',3,4,5-PeCB | PCB-86 | tbd | tbd | tbd |
| 2,2',3,4,5'-PeCB | PCB-87 | tbd | tbd | tbd |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| 2,2',3,4,6-PeCB | PCB-88 | tbd | tbd | tbd |
| 2,2',3,4,6'-PeCB | PCB-89 | tbd | tbd | tbd |
| 2,2',3,4',5-PeCB | PCB-90 | tbd | tbd | tbd |
| 2,2',3,4',6-PeCB | PCB-91 | tbd | tbd | tbd |
| 2,2',3,5,5'-PeCB | PCB-92 | tbd | tbd | tbd |
| 2,2',3,5,6-PeCB | PCB-93 | tbd | tbd | tbd |
| 2,2',3,5,6'-PeCB | PCB-94 | tbd | tbd | tbd |
| 2,2',3,5',6-PeCB | PCB-95 | tbd | tbd | tbd |
| 2,2',3,6,6'-PeCB | PCB-96 | tbd | tbd | tbd |
| 2,2',3',4,5-PeCB | PCB-97 | tbd | tbd | tbd |
| 2,2',3',4,6-PeCB | PCB-98 | tbd | tbd | tbd |
| 2,2',4,4',5-PeCB | PCB-99 | tbd | tbd | tbd |
| 2,2',4,4',6-PeCB | PCB-100 | tbd | tbd | tbd |
| 2,2',4,5,5'-PeCB | PCB-101 | tbd | tbd | tbd |
| 2,2',4,5,6'-PeCB | PCB-102 | tbd | tbd | tbd |
| 2,2',4,5,6'-PeCB | PCB-103 | tbd | tbd | tbd |
| 2,2',4,6,6'-PeCB | PCB-104 | tbd | tbd | tbd |
| 2,3,3'4,4'-PeCB | PCB-105 | tbd | tbd | tbd |
| 2,3,3',4,5-PeCB | PCB-106 | tbd | tbd | tbd |
| 2,3,3',4',5-PeCB | PCB-107 | tbd | tbd | tbd |
| 2,3,3',4,5'-PeCB | PCB-108 | tbd | tbd | tbd |
| 2,3,3',4,6-PeCB | PCB-109 | tbd | tbd | tbd |
| 2,3,3',4',6-PeCB | PCB-110 | tbd | tbd | tbd |
| 2,3,3',5,5'-PeCB | PCB-111 | tbd | tbd | tbd |
| 2,3,3',5,6-PeCB | PCB-112 | tbd | tbd | tbd |
| 2,3,3',5',6-PeCB | PCB-113 | tbd | tbd | tbd |
| 2,3,4,4',5-PeCB | PCB-114 | tbd | tbd | tbd |
| 2,3,4,4',6-PeCB | PCB-115 | tbd | tbd | tbd |
| 2,3,4,5,6-PeCB | PCB-116 | tbd | tbd | tbd |
| 2,3,4',5,6-PeCB | PCB-117 | tbd | tbd | tbd |
| 2,3',4,4',5-PeCB | PCB-118 | tbd | tbd | tbd |
| 2,3',4,4',6-PeCB | PCB-119 | tbd | tbd | tbd |
| 2,3',4,5,5'-PeCB | PCB-120 | tbd | tbd | tbd |
| 2,3',4,5,6-PeCB | PCB-121 | tbd | tbd | tbd |
| 2',3,3',4,5-PeCB | PCB-122 | tbd | tbd | tbd |
| 2',3,4,4',5-PeCB | PCB-123 | tbd | tbd | tbd |
| 2',3,4,5,5'-PeCB | PCB-124 | tbd | tbd | tbd |
| 2',3,4,5,6'-PeCB | PCB-125 | tbd | tbd | tbd |
| 3,3',4,4',5-PeCB | PCB-126 | tbd | tbd | tbd |
| 3,3',4,5,5'-PeCB | PCB-127 | tbd | tbd | tbd |
| 2,2',3,3',4,4'-HxCB | PCB-128 | tbd | tbd | tbd |
| 2,2',3,3',4,5-HxCB | PCB-129 | tbd | tbd | tbd |
| 2,2',3,3',4,5'-HxCB | PCB-130 | tbd | tbd | tbd |
| 2,2',3,3',4,6-HxCB | PCB-131 | tbd | tbd | tbd |
| 2,2',3,3',4,6'-HxCB | PCB-132 | tbd | tbd | tbd |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| 2,2',3,3',5,5'-HxCB | PCB-133 | tbd | tbd | tbd |
| 2,2',3,3',5,6-HxCB | PCB-134 | tbd | tbd | tbd |
| 2,2',3,3',5,6'-HxCB | PCB-135 | tbd | tbd | tbd |
| 2,2',3,3',6,6'-HxCB | PCB-136 | tbd | tbd | tbd |
| 2,2',3,4,4',5-HxCB | PCB-137 | tbd | tbd | tbd |
| 2,2',3,4,4',5'-HxCB | PCB-138 | tbd | tbd | tbd |
| 2,2',3,4,4',6-HxCB | PCB-139 | tbd | tbd | tbd |
| 2,2',3,4,4',6'-HxCB | PCB-140 | tbd | tbd | tbd |
| 2,2',3,4,5,5'-HxCB | PCB-141 | tbd | tbd | tbd |
| 2,2',3,4,5,6-HxCB | PCB-142 | tbd | tbd | tbd |
| 2,2',3,4,5,6'-HxCB | PCB-143 | tbd | tbd | tbd |
| 2,2',3,4,5',6-HxCB | PCB-144 | tbd | tbd | tbd |
| 2,2',3,4,6,6'-HxCB | PCB-145 | tbd | tbd | tbd |
| 2,2',3,4',5,5'-HxCB | PCB-146 | tbd | tbd | tbd |
| 2,2',3,4',5,6-HxCB | PCB-147 | tbd | tbd | tbd |
| 2,2',3,4',5,6'-HxCB | PCB-148 | tbd | tbd | tbd |
| 2,2',3,4',5',6-HxCB | PCB-149 | tbd | tbd | tbd |
| 2,2',3,4',6,6'-HxCB | PCB-150 | tbd | tbd | tbd |
| 2,2',3,5,5',6-HxCB | PCB-151 | tbd | tbd | tbd |
| 2,2',3,5,6,6'-HxCB | PCB-152 | tbd | tbd | tbd |
| 2,2',4,4',5,5'-HxCB | PCB-153 | tbd | tbd | tbd |
| 2,2',4,4',5',6-HxCB | PCB-154 | tbd | tbd | tbd |
| 2,2',4,4',6,6'-HxCB | PCB-155 | tbd | tbd | tbd |
| 2,3,3',4,4',5-HxCB | PCB-156 | tbd | tbd | tbd |
| 2,3,3',4,4',5'-HxCB | PCB-157 | tbd | tbd | tbd |
| 2,3,3',4,4',6-HxCB | PCB-158 | tbd | tbd | tbd |
| 2,3,3',4,5,5'-HxCB | PCB-159 | tbd | tbd | tbd |
| 2,3,3',4,5,6-HxCB | PCB-160 | tbd | tbd | tbd |
| 2,3,3',4,5',6-HxCB | PCB-161 | tbd | tbd | tbd |
| 2,3,3',4',5,5'-HxCB | PCB-162 | tbd | tbd | tbd |
| 2,3,3',4',5,6-HxCB | PCB-163 | tbd | tbd | tbd |
| 2,3,3',4',5',6-HxCB | PCB-164 | tbd | tbd | tbd |
| 2,3,3',5,5',6-HxCB | PCB-165 | tbd | tbd | tbd |
| 2,3,4,4',5,6-HxCB | PCB-166 | tbd | tbd | tbd |
| 2,3,4,4',5,5'-HxCB | PCB-167 | tbd | tbd | tbd |
| 2,3',4,4',5',6-HxCB | PCB-168 | tbd | tbd | tbd |
| 3,3',4,4',5,5'-HxCB | PCB-169 | tbd | tbd | tbd |
| 2,2',3,3',4,4',5-HpCB | PCB-170 | tbd | tbd | tbd |
| 2,2',3,3',4,4',6-HpCB | PCB-171 | tbd | tbd | tbd |
| 2,2',3,3',4,5,5'-HpCB | PCB-172 | tbd | tbd | tbd |
| 2,2',3,3',4,5,6-HpCB | PCB-173 | tbd | tbd | tbd |
| 2,2',3,3',4,5,6'-HpCB | PCB-174 | tbd | tbd | tbd |
| 2,2',3,3',4,5',6-HpCB | PCB-175 | tbd | tbd | tbd |
| 2,2',3,3',4,6,6'-HpCB | PCB-176 | tbd | tbd | tbd |
| 2,2',3,3',4',5,6-HpCB | PCB-177 | tbd | tbd | tbd |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| 2,2',3,3',5,5',6-HpCB | PCB-178 | tbd | tbd | tbd |
| 2,2',3,3',5,6,6'-HpCB | PCB-179 | tbd | tbd | tbd |
| 2,2',3,4,4',5,5'-HpCB | PCB-180 | tbd | tbd | tbd |
| 2,2',3,4,4',5,6-HpCB | PCB-181 | tbd | tbd | tbd |
| 2,2',3,4,4',5,6'-HpCB | PCB-182 | tbd | tbd | tbd |
| 2,2',3,4,4',5',6-HpCB | PCB-183 | tbd | tbd | tbd |
| 2,2',3,4,4',6,6'-HpCB | PCB-184 | tbd | tbd | tbd |
| 2,2',3,4,5,5',6-HpCB | PCB-185 | tbd | tbd | tbd |
| 2,2',3,4,5,6,6'-HpCB | PCB-186 | tbd | tbd | tbd |
| 2,2',3,4,5,5',6-HpCB | PCB-187 | tbd | tbd | tbd |
| 2,2',3,4',5,6,6'-HpCB | PCB-188 | tbd | tbd | tbd |
| 2,3,3',4,4',5,5'-HpCB | PCB-189 | tbd | tbd | tbd |
| 2,3,3',4,4',5,6-HpCB | PCB-190 | tbd | tbd | tbd |
| 2,3,3',4,4',5',6-HpCB | PCB-191 | tbd | tbd | tbd |
| 2,3,3',4,5,5',6-HpCB | PCB-192 | tbd | tbd | tbd |
| 2,3,3',4',5,5',6-HpCB | PCB-193 | tbd | tbd | tbd |
| 2,2',3,3',4,4',5,5'-OcCB | PCB-194 | tbd | tbd | tbd |
| 2,2',3,3',4,4',5,6-OcCB | PCB-195 | tbd | tbd | tbd |
| 2,2',3,3',4,4',5,6'-OcCB | PCB-196 | tbd | tbd | tbd |
| 2,2',3,3',4,4',6,6'-OcCB | PCB-197 | tbd | tbd | tbd |
| 2,2',3,3',4,5,5',6-OcCB | PCB-198 | tbd | tbd | tbd |
| 2,2',3,3',4,5,5',6'-OcCB | PCB-199 | tbd | tbd | tbd |
| 2,2',3,3',4,5,6,6'-OcCB | PCB-200 | tbd | tbd | tbd |
| 2,2',3,3',4,5',6,6'-OcCB | PCB-201 | tbd | tbd | tbd |
| 2,2',3,3',5,5',6,6'-OcCB | PCB-202 | tbd | tbd | tbd |
| 2,2',3,4,4',5,5',6-OcCB | PCB-203 | tbd | tbd | tbd |
| 2,2',3,4,4',5,6,6'-OcCB | PCB-204 | tbd | tbd | tbd |
| 2,3,3',4,4',5,5',6-OcCB | PCB-205 | tbd | tbd | tbd |
| 2,2',3,3',4,4',5,5',6-NoCB | PCB-206 | tbd | tbd | tbd |
| 2,2',3,3',4,4',5,6,6'-NoCB | PCB-207 | tbd | tbd | tbd |
| 2,2',3,3',4,5,5',6,6'-NoCB | PCB-208 | tbd | tbd | tbd |
| DeCB | PCB-209 | tbd | tbd | tbd |
| **Chlorinated Dioxins and Furans[j]** | | | **pg/g dry wt** | |
| 2,3,7,8-TCDD | 1746-01-6 | **0.0001** | 0.026 | 0.2 |
| 2,3,7,8-TCDF | 51207-31-9 | **0.001** | 0.020 | 0.2 |
| 1,2,3,7,8-PeCDD | 40321-76-4 | **0.001** | 0.029 | 0.5 |
| 1,2,3,7,8-PeCDF | 57117-41-6 | **0.001** | 0.017 | 0.5 |
| 2,3,4,7,8-PeCDF | 57117-31-4 | **0.0002** | 0.017 | 0.5 |
| 1,2,3,4,7,8-HxCDD | 39227-28-6 | **0.01** | 0.030 | 0.5 |
| 1,2,3,6,7,8-HxCDD | 57653-85-7 | **0.01** | 0.034 | 0.5 |
| 1,2,3,7,8,9-HxCDD | 19408-74-3 | **0.01** | 0.032 | 0.5 |
| 1,2,3,4,7,8-HxCDF | 70648-26-9 | **0.01** | 0.013 | 0.5 |
| 1,2,3,6,7,8-HxCDF | 57117-44-9 | **0.01** | 0.013 | 0.5 |
| 1,2,3,7,8,9-HxCDF | 72918-21-9 | **0.01** | 0.017 | 0.5 |

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|
| 2,3,4,6,7,8-HxCDF | 60851-34-5 | **0.01** | 0.013 | 0.5 |
| 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | 0.09 | 0.035 | 0.5 |
| 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | 0.09 | 0.033 | 0.5 |
| 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | 0.09 | 0.052 | 0.5 |
| OCDD | 3268-87-9 | 9.4 | 0.061 | 1.0 |
| OCDF | 39001-02-0 | 9.4 | 0.065 | 1.0 |
| Total tetrachlorinated dioxins | 41903-57-5 | * | -- | -- |
| Total pentachlorinated dioxins | 36088-22-9 | * | -- | -- |
| Total hexachlorinated dioxins | 34465-46-8 | * | -- | -- |
| Total heptachlorinated dioxins | 37871-00-4 | * | -- | -- |
| Total tetrachlorinated furans | 30402-14-3 | * | -- | -- |
| Total pentachlorinated furans | 30402-15-4 | * | -- | -- |
| Total hexachlorinated furans | 55684-94-1 | * | -- | -- |
| Total heptachlorinated furans | 38998-75-3 | * | -- | -- |

Notes:

[a] Values are provided in bold font when the MRL is not expected to meet the ACG. ACGs for PCB congeners to be determined.

[b] The laboratory's current MDL is provided when an MDL study has been completed for the proposed method. When no MDL is provided, the laboratory will complete an MDL study prior to analysis of samples for this project.

[c] The MRL is provided on a dry-weight basis and assumes 50% moisture in the samples. The MRL for project samples will vary with moisture content in the samples. The MRL represents the level of lowest calibration standard (i.e., the practical quantitation limit).

[d] Grain-size intervals will include the following:

| | | |
|---|---|---|
| Gravel | Very fine sand | Clay, phi size 8-9 |
| Very coarse sand | Coarse silt | Clay, phi size 9-10 |
| Coarse sand | Medium silt | Clay, phi size >10 |
| Medium sand | Fine silt | |
| Fine sand | Very fine silt | |

[e] The MDLs for the herbicides and pentachlorophenol are expected to be lower than the ACGs.

[f] Total chlordane will be calculated as the sum of the 5 components listed above this entry.

[g] 1,4-Dichlorobenzene will also be analyzed by purge-and-trap GC/MS with the VOCs to improve MRLs.

[h] Hexachlorobenzene, hexachloroethane, and hexachlorobutadiene will also be analyzed by GC/ECD with the pesticides to improve MRLs.

[i] Pentachlorophenol will also be analyzed with the herbicides to improve the MRL.

[j] Expected MDLs are shown. MDLs for PCB congeners and dioxins and furans are sample-dependent and will vary from the indicated values.

[k] MDLs and MRLs are shown for a sample weight of 10 g. MDLs and MRLs will be lower for a larger sample size.

ACG = Analytical concentration goals; established by EPA during *ad hoc* meeting with LWG May 10, 2002
MDL = Method detection limit
MRL = Method reporting limit

Table 2.4. Method Reporting Limits and Analytical Concentration Goals for Sediment Trap Samples.

| Analyte | CAS number | ACG[a] | MDL[b] | MRL[c] |
|---|---|---|---|---|

NA = Not applicable
tbd = To be determined
* = A risk-based ACG has not been established

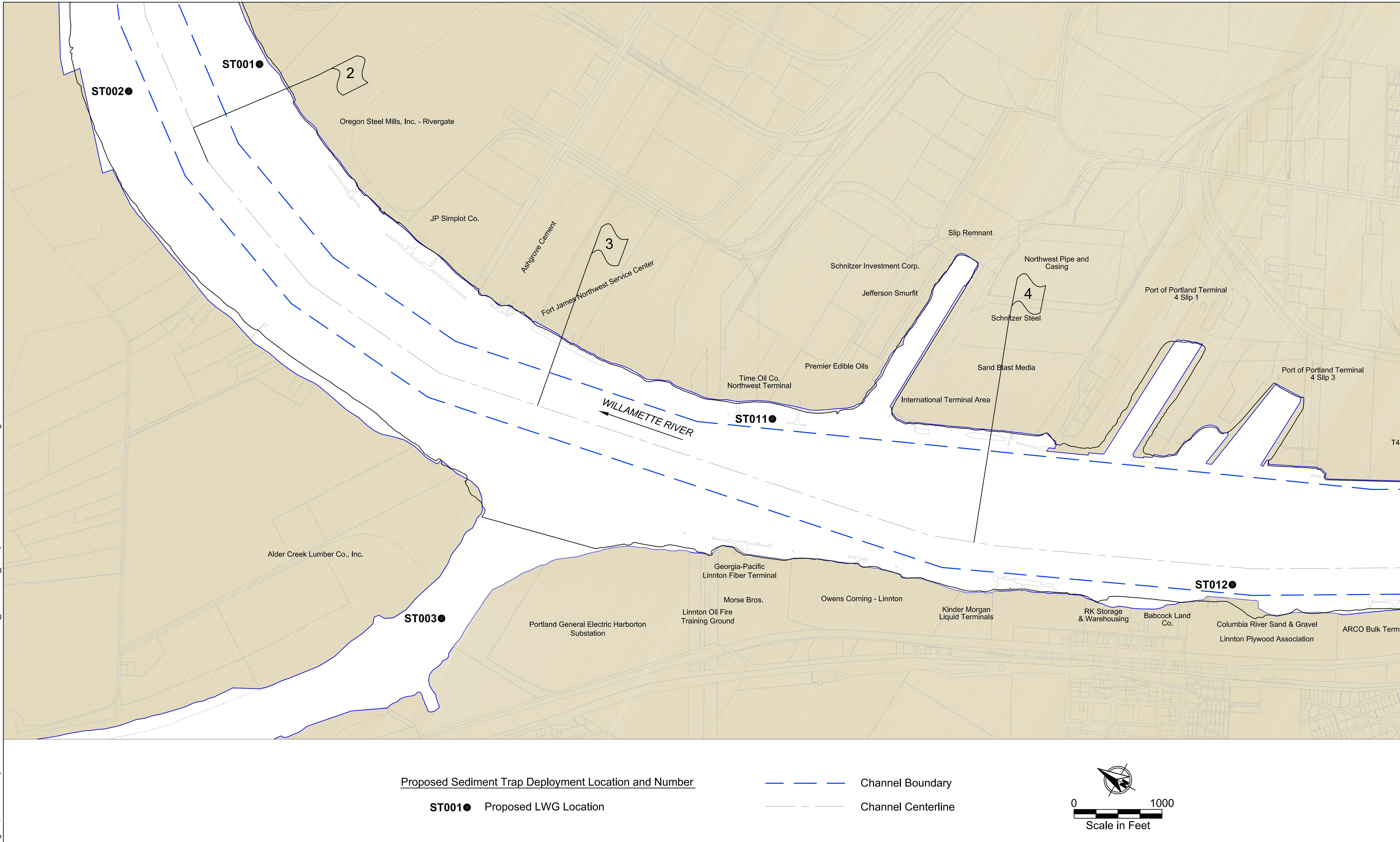
Table 3-1. Sample Containers, Preservation, Holding Times, and Sample Volumes for Sediment Trap Samples.

| Container[1] Type | Size | Laboratory | Analysis | Preservation | Holding Time | Minimum Sample Size[2] |
|---|---|---|---|---|---|---|
| **Sediment samples** | | | | | | |
| G/P | 8 oz | CAS | Grain size (sediment) | 4±2ºC | 6 months | 100 g |
| WMG | 16 oz [3] | CAS | Total organic carbon | | 28 days[4] | 1 g |
| | | | Mercury | | 28 days[5] | 5 g |
| | | | Metals and total solids | | 6 months[4] | 10 g |
| | | | Hexavalent chromium | | 1 month/7 days[6] | 5 g |
| | | | Butyltins | | 14 days[4] | 20 g |
| | | | TPH - diesel- and oil-range | | 14 days[4] | 20 g |
| WMG | 2 oz | CAS | TPH - gasoline range | No headspace; 4±2ºC (do not freeze) | 14 days | 5 g |
| WMG | 2 oz | CAS | VOCs | No headspace; 4±2ºC (do not freeze) | 14 days | 5 g |
| WMG | 16 oz | CAS | SVOCs | Deep Frozen (-20ºC) | 1 year | 45 g |
| | | | Pesticides | | 1 year | 30 g |
| WMG | 8 oz | CAS | Herbicides | Deep Frozen (-20ºC) | 1 year | 45 - 60 g |
| WMG | 8 oz | CAS | PCDD/PCDFs | Deep Frozen (-20ºC) | 1 year | 50 g |
| WMG | 8 oz | Alta | PCB congeners | Deep Frozen (-20ºC) | 1 year | 10 g |
| WMG | 2 - 8 oz | CAS | Archival | Deep Frozen (-20ºC) | 1 year | not applicable |
| **Equipment Rinse Blanks** | | | | | | |
| HDPE | 500 mL | CAS | Metals and Mercury | 5 ml of 1:1& $HNO_3$ & 4±2ºC | 6 months/60 days[7] | 100 ml |
| Poly-carbonate | 500 mL | CAS | Butyltins | Dark; 4±2ºC | 7 days | 500 mL |
| VOA vial | 2 oz/ septum | CAS | TPH - gasoline | No headspace; HCl to pH 2; 4±2ºC | 14 days | 5 mL |
| AG | 500 mL | CAS | TPH - diesel and oil | HCl to pH 2; 4±2ºC | 14 days | 500 mL |
| VOA vial | 2 oz/ septum | CAS | VOCs | No headspace; HCl to pH 2; 4±2ºC | 14 days | 5 mL |
| AG | 500 mL | CAS | SVOCs | Dark; 4±2ºC | 7 days/40 days[8] | 500 mL |
| AG | 500 mL | CAS | Pesticides | Dark; 4±2ºC | 7 days/40 days[8] | 500 mL |
| AG | 500 mL | CAS | Herbicides | Dark; 4±2ºC | 7 days/40 days[8] | 500 mL |
| AG | 500 mL | CAS | Dioxins/Furans | Dark; 4±2ºC/-10ºC[8] | 1 year/1 year[8] | 500 mL |
| AG | 500 mL | CAS | PCB congeners | Sulfuric acid to pH 2-3; 4±2ºC/-10ºC[8] | 1 year/1 year[9] | 500 mL |

WMG = Wide Mouth Glass
HDPE = High Density Polyethylene
AG = Amber Glass
G/P = Glass or Plastic

[1]Size and number of containers may be modified by analytical laboratory.
[2]All samples will need a minimum of 5% QA. Collection of 3x normal sample size listed will be necessary.
[3]An additional 8 oz to 16 oz jar needed for lab QC for 5% of samples.
[4]Holding times for frozen samples are as follows: Total organic carbon, 1 year; metals (except mercury), 2 years; butyltin species, 6 months; diesel- and oil-range TPH, 1 year.
[5]The holding time for mercury in frozen (i.e, archived) samples is 180 days, as approved by EPA (Humphrey 2002).
[6]Holding time is 1 month to extraction and extracts must be analyzed within 7 days from extraction.
[7]Based on EPA Method 1631 Revision D.
[8]Holding time is 7 days to extraction and extracts must be analyzed within 40 days from extraction.
[9]Conditions for equipment blanks/conditions for extracts.

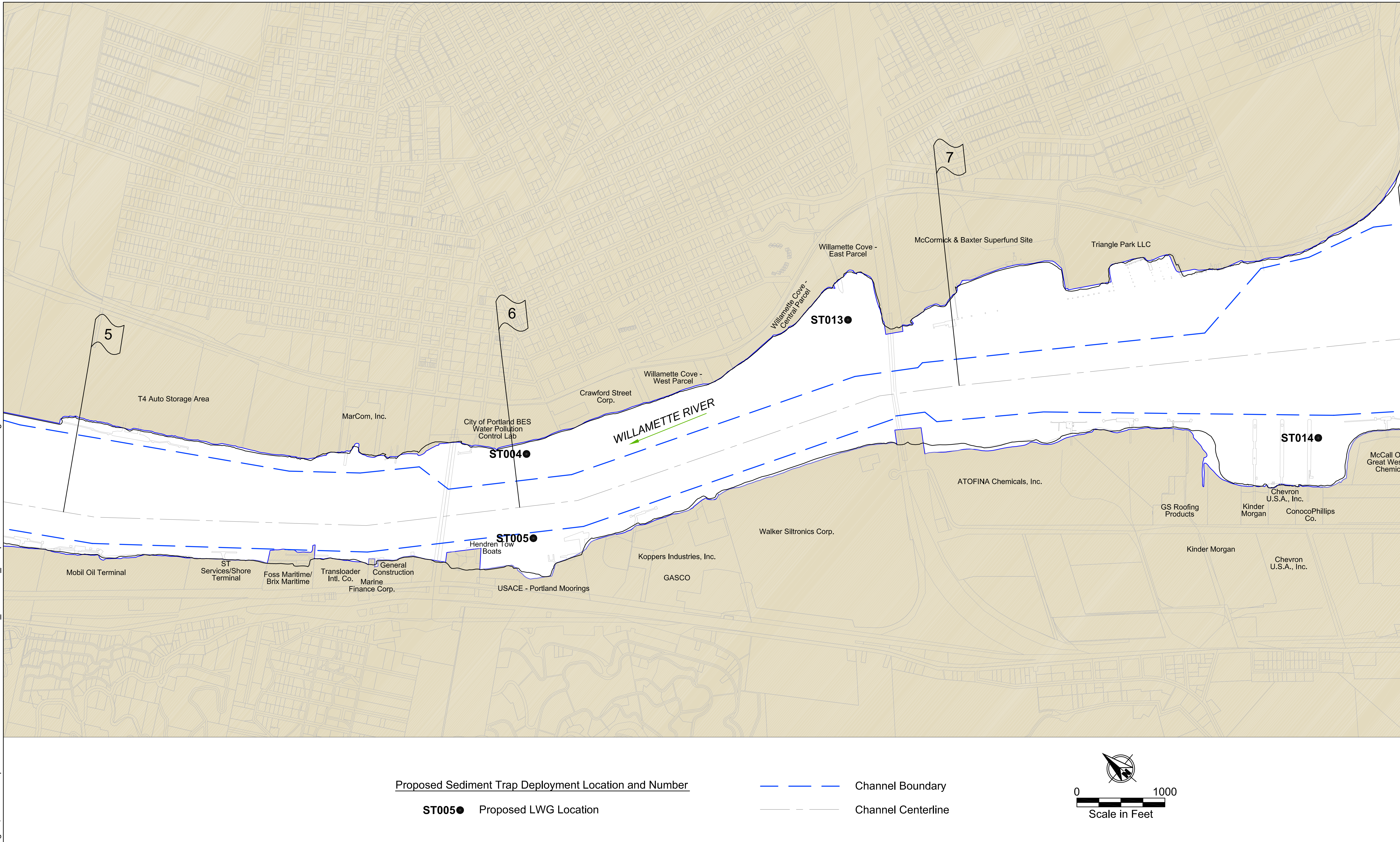
# Figures




Aug 22, 2006 12:01pm hlevasseur K:Jobs010142-Lower_Willamette_Group01014201014201-27.dwg FIG 2-1a

ANCHOR ENVIRONMENTAL, L.L.C.

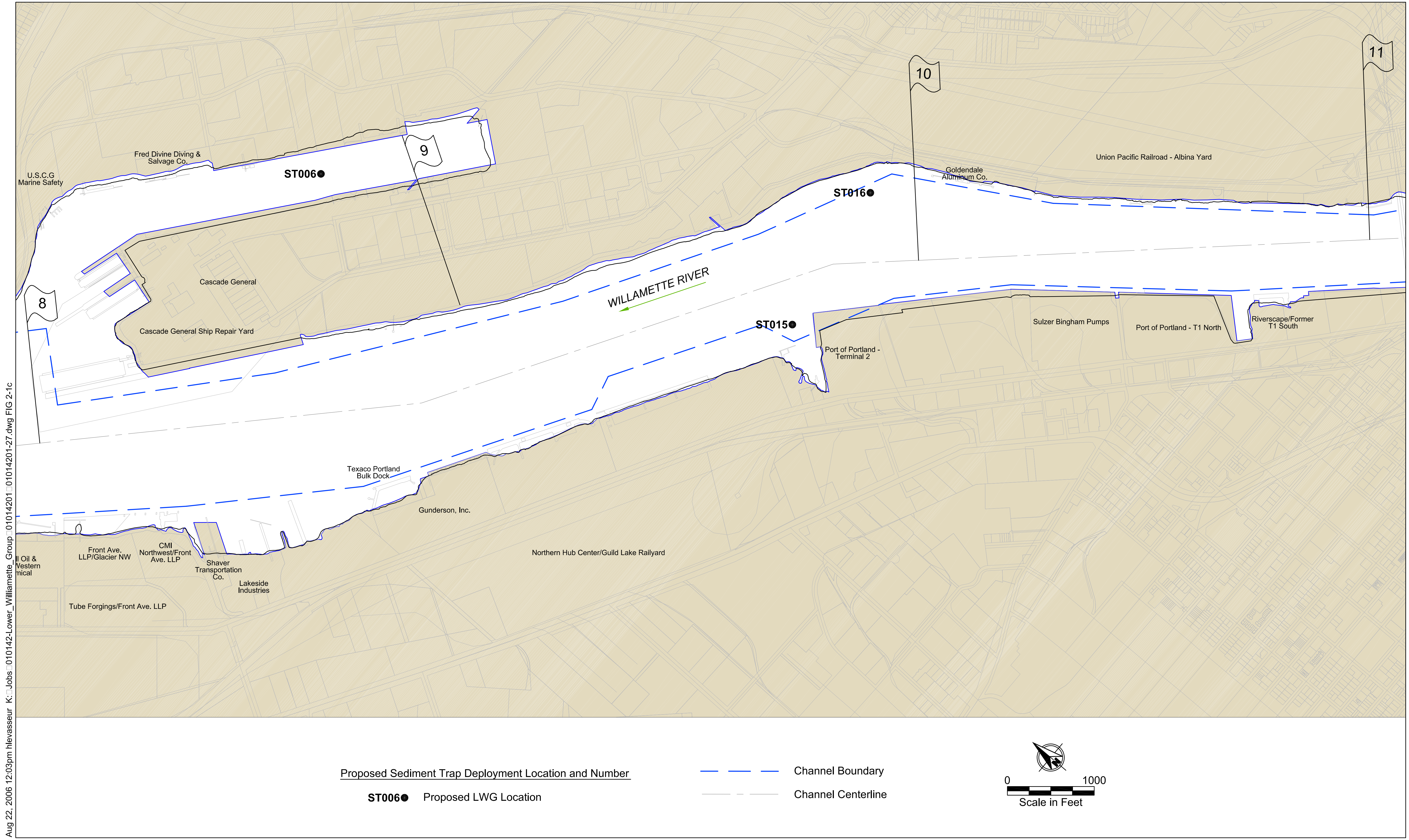
**Figure 2-1a**
Portland Harbor RI/FS
Round 3 Field Sampling Plan
Proposed Sediment Trap Deployment Locations




Aug 22, 2006 12:02pm hlevasseur K:\Jobs\010142-Lower_Willamette_Group\01014201\01014201-27.dwg FIG 2-1b

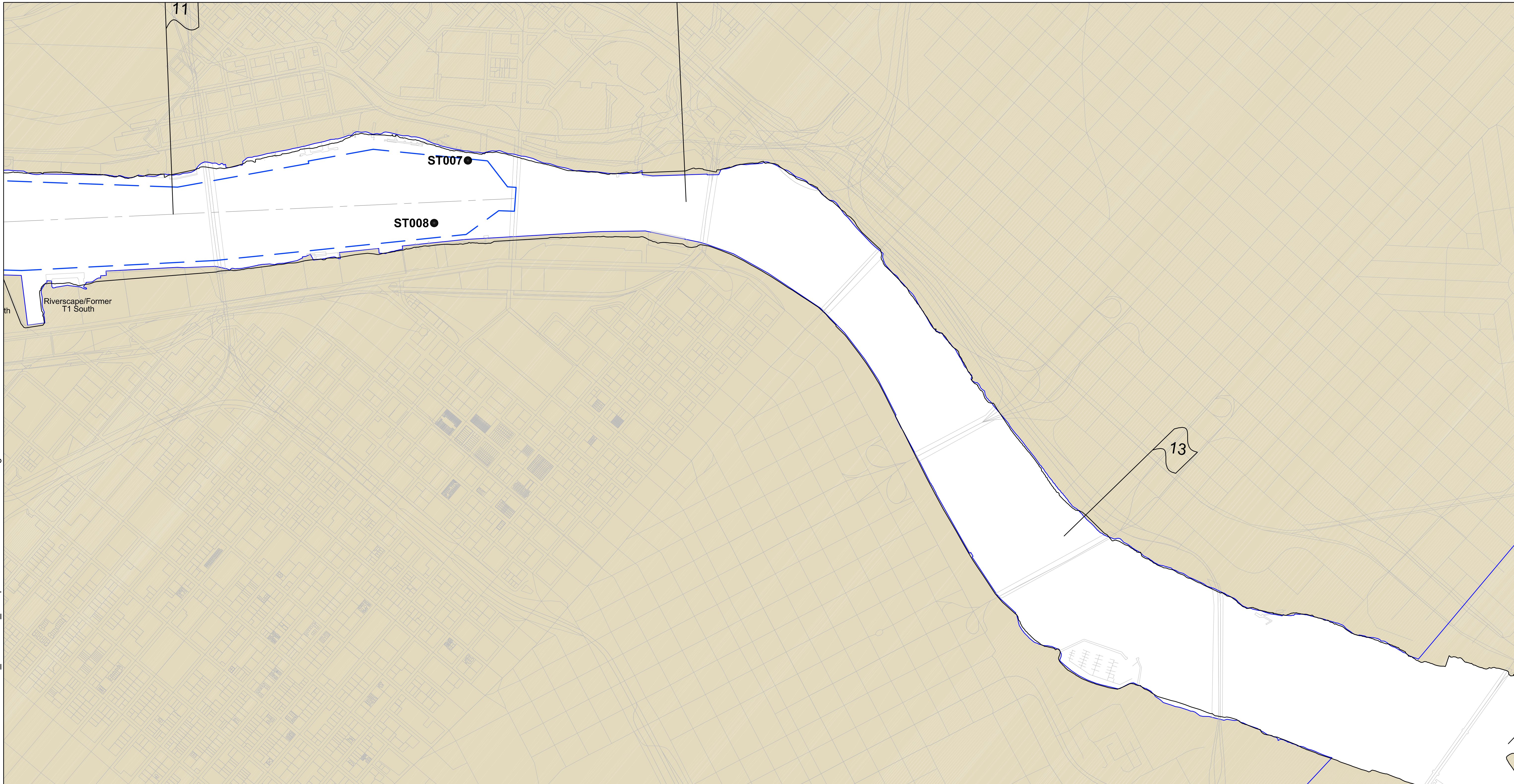
ANCHOR ENVIRONMENTAL, L.L.C.

**Figure 2-1b**
Portland Harbor RI/FS
Round 3 Field Sampling Plan
Proposed Sediment Trap Deployment Locations




ANCHOR ENVIRONMENTAL, L.L.C.

**Figure 2-1c**
Portland Harbor RI/FS
Round 3 Field Sampling Plan
Proposed Sediment Trap Deployment Locations




Proposed Sediment Trap Deployment Location and Number

ST007 ● Proposed LWG Location

Channel Boundary

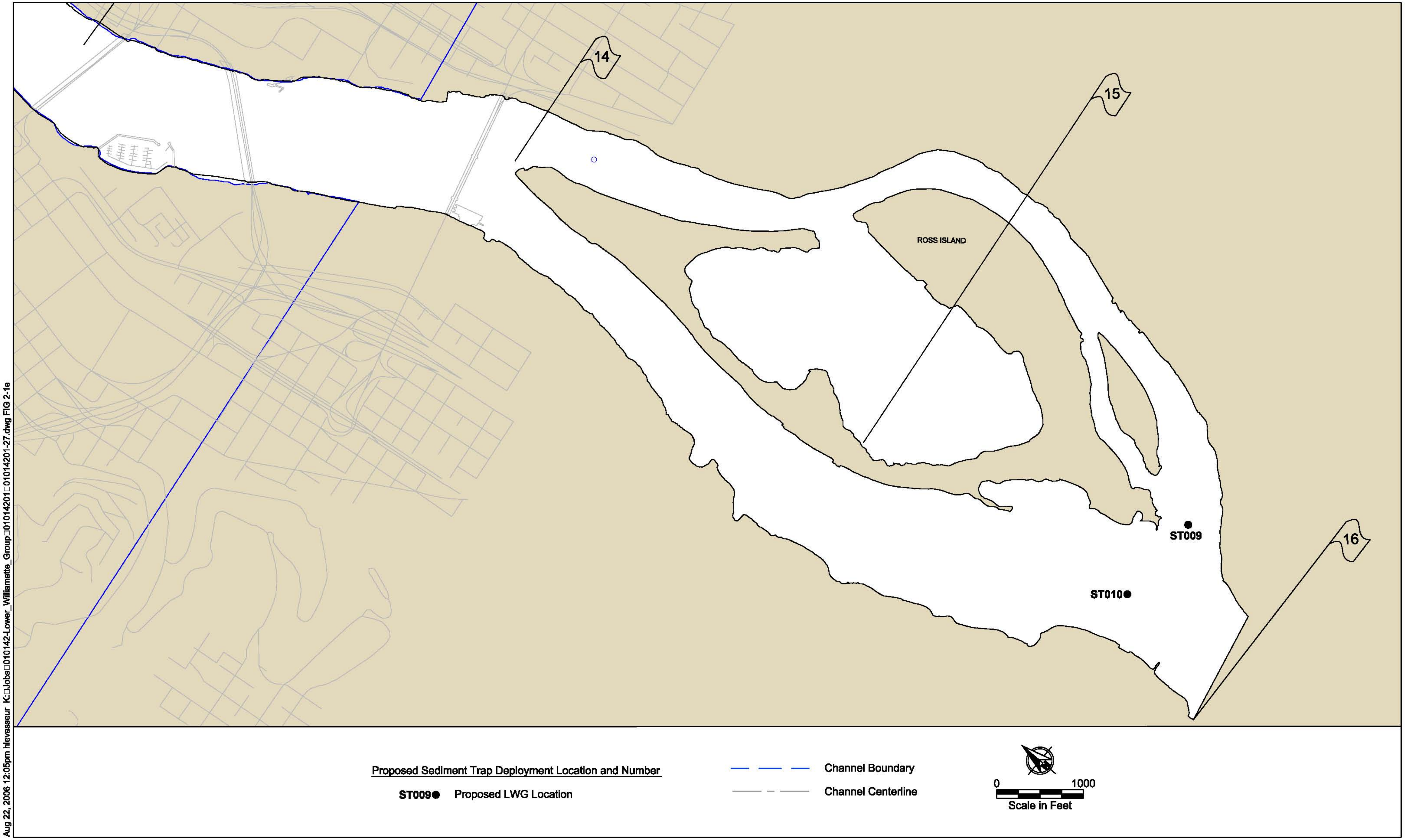
Channel Centerline

0 1000
Scale in Feet

Aug 22, 2006 12:04pm hlevasseur K:\Jobs\010142-Lower_Willamette_Group\01014201\01014201-27.dwg FIG 2-1d

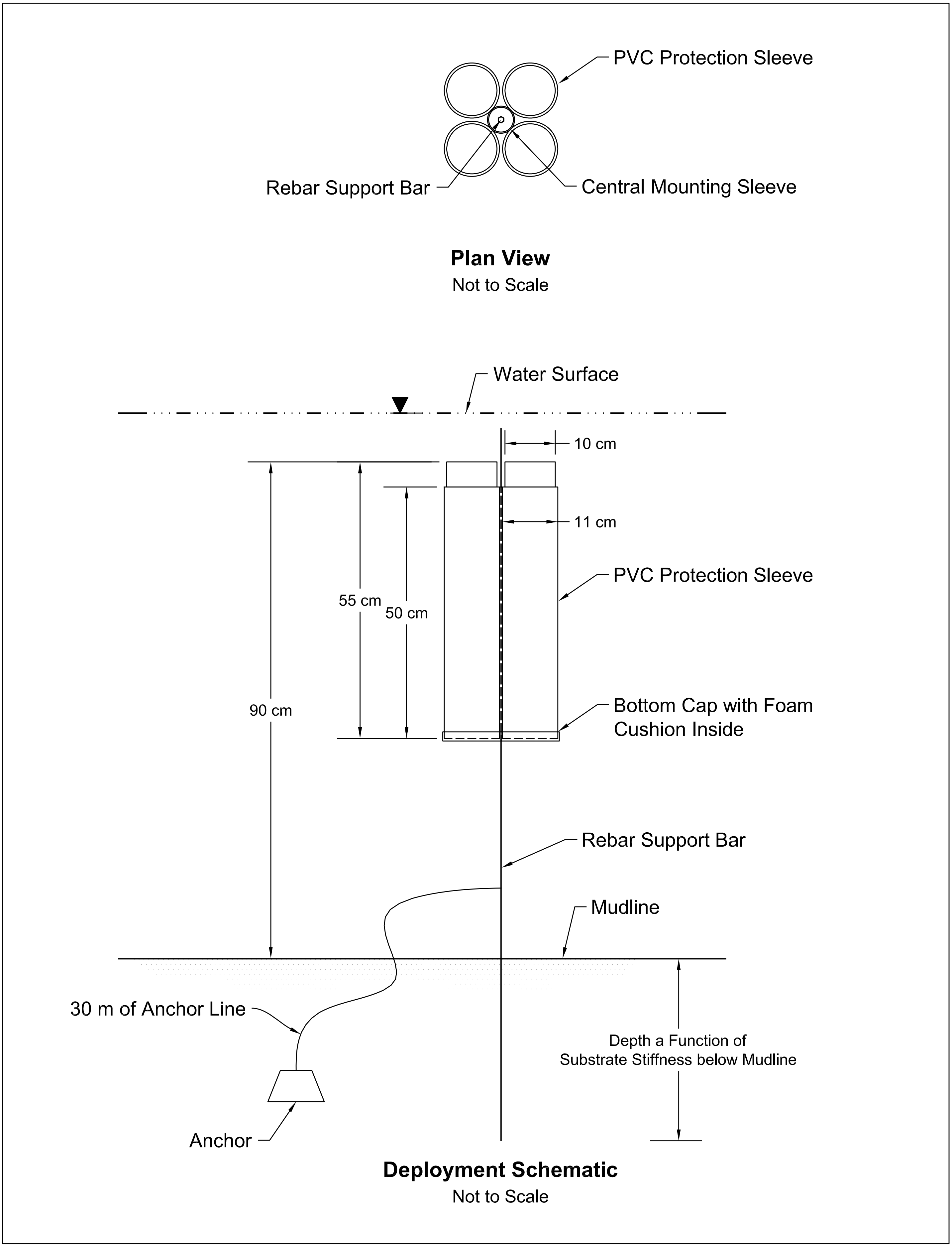
ANCHOR ENVIRONMENTAL, L.L.C.

**Figure 2-1d**
Portland Harbor RI/FS
Round 3 Field Sampling Plan
Proposed Sediment Trap Deployment Locations




ANCHOR ENVIRONMENTAL, L.L.C.

**Figure 2-1e**
Portland Harbor RI/FS
Round 3 Field Sampling Plan
Proposed Sediment Trap Deployment Locations




Dec 23, 2005 3:41pm cdavidson K:\Jobs\010142-Lower_Williamette_Group\01014201\01014201-25.dwg Figure 3-1

ANCHOR ENVIRONMENTAL, L.L.C.

**Figure 3-1**
Portland Harbor RI/FS
Round 3 Field Sampling Plan
Sediment Trap Construction and Deployment Schematic